WINTER 2008

Live

from the **California Academy of Sciences**

Squawk of the town:

Academy receives Platinum rating

Look Inside:

- Beetles on thin ice
- Climate conversations
- Winter calendar of events
- Guide to the night sky

CALIFORNIA
ACADEMY OF
SCIENCES

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"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change." So wrote Charles Darwin as he explained his theory of evolution by natural selection 150 years ago. Today, that theory is one of the central tenets of modern science. Beginning February 12, the Academy will celebrate the 200th anniversary of Darwin's birth by hosting a series of evolution-themed programs and lectures (see page 14 for more information).

As Darwin noted, some life-forms thrive, reproduce, and adapt as conditions change, while others disappear. Because of global climate change, many habitats are now changing in rapid and measurable ways. In this issue, two Academy scientists discuss the impacts of climate change on beetles and bivalves—as well as on humans. If their stories inspire you to take action, stop by the *Altered State* exhibit during your next visit to the Academy to pick up a few resource-saving tips. And be sure to share your good ideas with us as well!

We hope you've enjoyed exploring your new Academy as much as we've enjoyed sharing it with you. With 38,000 live animals in the building, there's always something new to see—and you can beat the crowds by visiting during members-only hours every Tuesday and Sunday morning. We look forward to seeing you here soon.

Greg Farrington
Executive Director

Live contents

4

Specimen Spotlight

Sun Star

A top predator in its day, this sun star specimen was collected by John Steinbeck and Edward Ricketts.

5

Creature Closeup

Military Macaw

This gregarious rainforest resident is just as vocal as it is colorful.

6

In the News

Achieving LEED Platinum

The U.S. Green Building Council has awarded the new Academy with its highest possible rating.

SOLAR ECLIPSE
CHINA 中國
July 15-24, 2009

7

On Location

Viewing the Solar Eclipse in China

Observe the longest solar eclipse of the century on a spectacular Academy Travel adventure with Bing Quock.

14

Programs & Lectures

Dive into an exciting lineup of special programs, including a series of lectures in honor of Darwin's 200th birthday.

20

Skyguide

This comprehensive guide to the winter night sky will turn you into a stargazing guru.

Features

8

From the Field

Beetles on the Rise

As snowfields melt and tree-lines shift, Academy entomologist Dave Kavanaugh finds himself hiking to higher ground to find the beetles he has studied for 40 years.

LIVING IN A WARMING CLIMATE
A TREE PAYS THE PRICE
HOT TIMES ARE COMING
What Will Happen as California Heats Up?

16

From the Field

Altered State

Academy scientist Peter Roopnarine discusses his recent climate change research, the surprising reactions it has elicited, and the future our children will inherit.

22

Q&A

Diane Ososke and Martha Kropf

Meet Diane Ososke and Martha Kropf, both longtime members of the Academy family.

24

On the Scene

Snapshots from the new Academy's opening events.

26

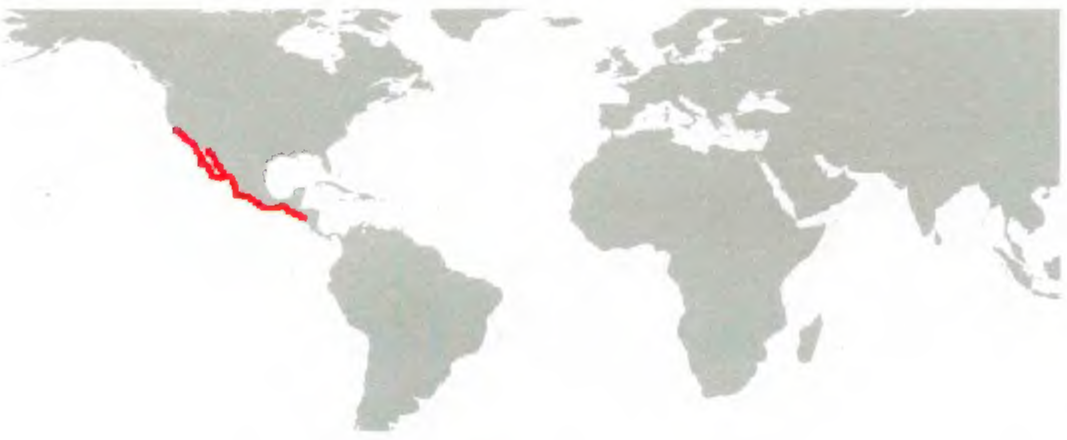
Credits

On the Cover

Meet Django and Duke, the Academy's pair of Military Macaws. These birds take their names from acclaimed jazz artists Django Reinhart and Duke Ellington. Like Reinhart, who lost the use of two fingers on his left hand, the Academy's Django is missing two toes on his left foot. Learn more in the Creature Closeup on page 5. Cover photo by Olivier Laude.

On the Back

Take a closer look at one of the Academy's most popular new residents—Claude, the albino alligator.



Where in the World

Heliaster kubiniji inhabits the intertidal zone along Mexico's Gulf of California. The intertidal zone is a harsh environment, alternating between the crashing waves of high tide and the dry, sun-scorching exposure of low tide. *H. kubiniji* has also been reported as far north as California and as far south as Nicaragua.

Academy Collection

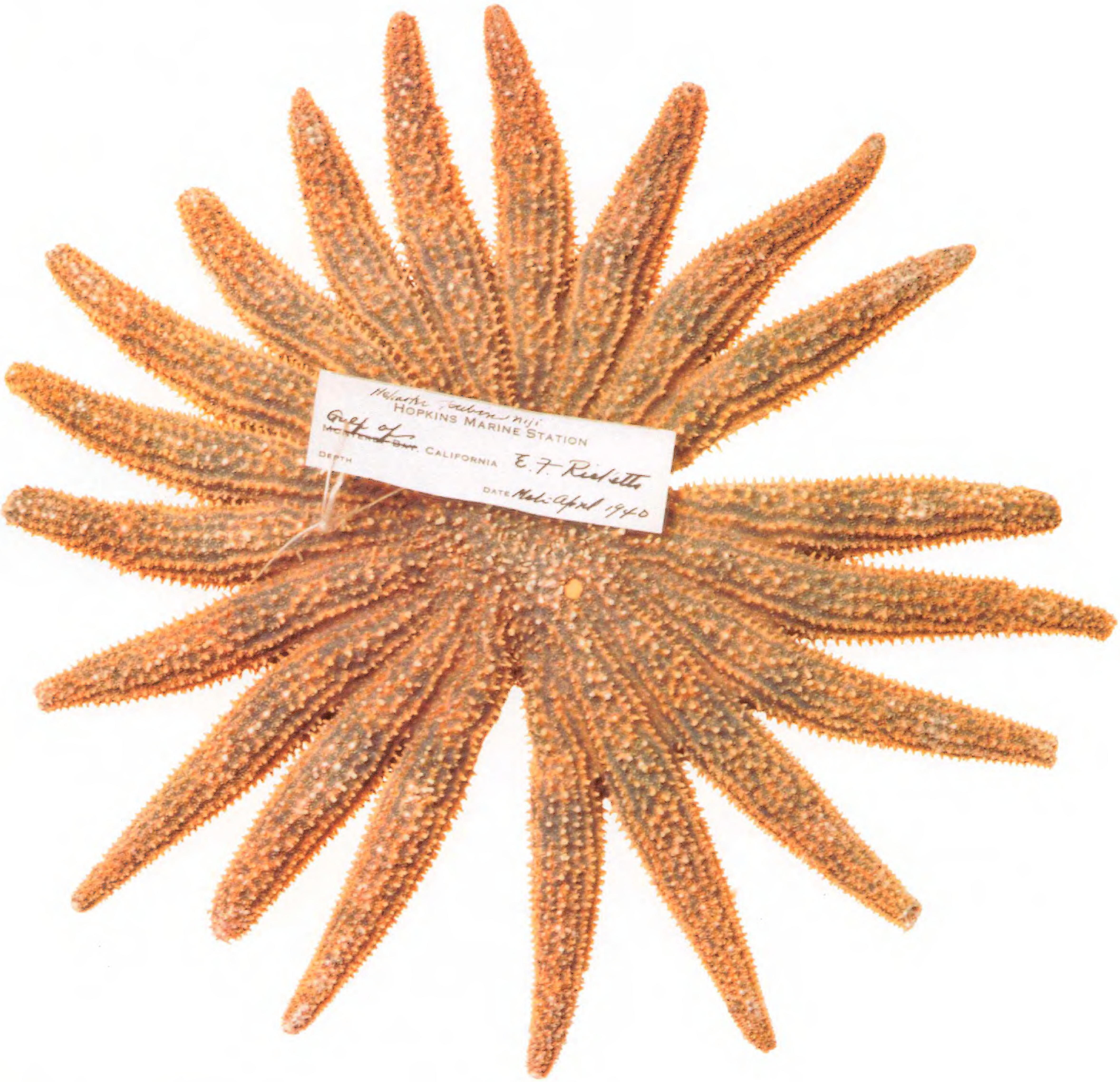
The Academy's invertebrate zoology department houses 40 specimens of *H. kubiniji*, four of which were collected by Edward Ricketts. Ricketts's specimens were originally housed at the Hopkins Marine Station in Pacific Grove, California. In 1972, the marine station and its parent organization, Stanford University, transferred 10 tons of scientific specimens to the Academy, including Ricketts's sun stars.

Diet

The barnacle *Chthamalus anisopoma* is the sun star's principal prey. Like all sea stars, the sun star's mouth is located in the center of its body, on the underside. Once the sun star drapes over a meal, it can force its stomach out of its mouth to digest the prey externally.

Sea Star vs. Starfish

Confused by the terms "sea star" and "starfish"? They both refer to the same group of animals. "Starfish," however, is a misnomer—these animals are not actually fish but are echinoderms, the group of spiny-skinned creatures that includes sea lilies, urchins, and sea cucumbers.



Sun Star

"Nights at anchor in the Gulf are quiet and strange. The water is smooth, almost solid, and the dew is so heavy that the decks are soaked. The little waves rasp on the shell beaches with a hissing sound, and all about in the darkness the fishes jump and splash." So wrote John Steinbeck in his 1951 book, *The Log from the Sea of Cortez*. This nonfiction work gives a day-by-day account of his 1940 expedition to the Gulf of California to collect intertidal animals. Accompanying him was Edward Ricketts, a marine biologist and close friend. Steinbeck and Ricketts collected numerous specimens during their six-week expedition, including the sun star (*Heliaster kubiniji*) pictured above, which now resides in the Academy's collections.

"By now, some animals began to emerge as ubiquitous. *Heliaster kubiniji*, the sun-star, was virtually everywhere..." As Steinbeck noted, the sun star was a top predator in the Gulf of California during his time. But in 1978, an El Niño event brought warmer sea temperatures and made the sun stars susceptible to a microbial disease. The disease caused almost all of them to break apart and die. The sun star has never fully recovered from this population crash, and today remains rare or absent at some sites in the Gulf.

Readers of Steinbeck's *Log* will find not only ecological information, but also poetic musings about the natural world, such as the following: "One thing had impressed us deeply on this little voyage: the great world dropped away very quickly. We lost the fear and fierceness and contagion of war and economic uncertainty. The matters of great importance we had left were not important.... A playful swordfish, jumping and spinning, absorbed us completely. There was time to observe the tremendous minutiae of the sea."

Photo: Sharon Beals

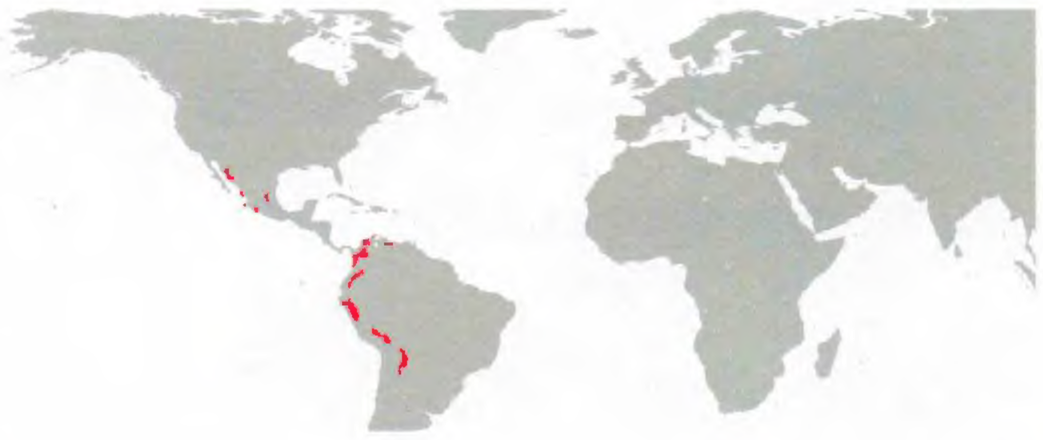
Military Macaw

With its flashy tail feathers and riotously colorful face, the Military Macaw (*Ara militaris*) is easy to spot—but it's even easier to hear. This gregarious parrot lives in groups of 20 to 40 birds, and the boisterous calls it uses to communicate with other members of the flock often travel considerable distances. Like other parrots, Military Macaws possess the rare ability to learn and produce new vocal sounds by mimicking the sounds around them, including human words. Recent brain volume studies have shown that primates and parrots have similar relative brain sizes.

In the wild, Military Macaws feed mostly on seeds, nuts, and fruits. However, their diet also includes another surprising ingredient—mineral-rich clay. Each morning, the birds visit heaps of clay called "macaw-licks" and consume a few grams of clay. By analyzing soil samples from several Peruvian macaw-lick sites, scientists have found that this clay has the ability to absorb large quantities of alkaloid quinine, a toxin that occurs naturally at low levels in most parrot diets. The clay also increases mucus secretion, further protecting the stomach lining from dietary toxins. Once they've had their daily dose of clay, the macaws are able to eat larger quantities of seeds and fruits that would otherwise make them sick.

Military Macaws typically live for 50 or 60 years, and in captivity they can survive even longer. After they reach sexual maturity, they form monogamous pair bonds that often last for the duration of their lives.

Photo: Olivier Laude



Where in the World

Military Macaws occupy a large but highly fragmented range from Mexico to Argentina. Over the past 50 years, their population numbers have declined dramatically, mostly due to habitat loss and the pet trade. Current estimates place the wild population at around 10,000 birds. They are now listed as Vulnerable by the International Union for Conservation of Nature.

Where in the Academy

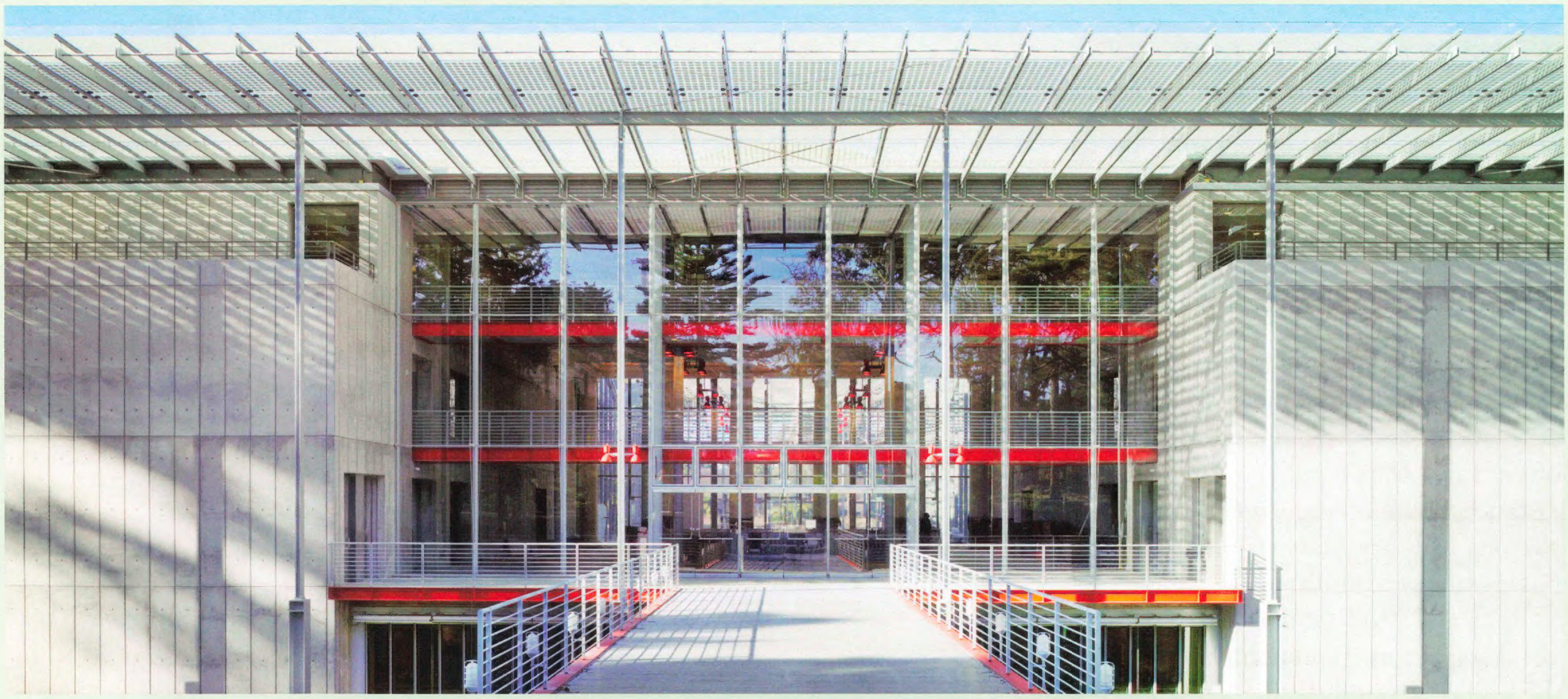
The Academy's pair of Military Macaws spend their days perched on a Madrone tree in the Rainforests of the World exhibit. At night, an Academy biologist takes them to a special holding room behind-the-scenes to make sure they get a good night's sleep.

House Hunters

Rather than building their own nests, these birds look for hollows inside tree trunks or cavities in the face of a cliff wall. When forests are logged, the macaws lose valuable nesting sites.

Prized Possessions

Because of their colorful plumage, Military Macaws have been valued by humans for thousands of years. Their blue-green tail feathers were highly prized by a number of Pre-Columbian civilizations, including the Olmec, Maya, and Inca, and their bones have been found in archaeological sites dating back to 1200 BC or earlier.



Setting a New Standard

The Academy achieves its LEED Platinum rating with flying colors.

THE NEW ACADEMY is now officially the greenest museum in the world.

After years of anticipation, on October 7, 2008, the U.S. Green Building Council awarded the new facility its highest possible certification: LEED Platinum. This makes the Academy the largest public Platinum-rated building in the world, and with a total score of 54 points, it is also the world's most sustainable museum building.

LEED is short for the Leadership in Energy and Environmental Design rating system—a voluntary, consensus-based standard for evaluating sustainable buildings. Points are awarded in six categories, and ratings are based not only on the design and construction of a building, but also on its day-to-day operation. Read on to find out where the Academy's 54 points came from.

Sustainable Sites

The new Academy reduces the urban heat island effect, thanks to the building's 2.5-acre living roof and the strategic use of shade in the surrounding grounds. It was also built on a previously developed site, and includes bicycle parking, an electric car refueling station, and easy access to public transit.

Water Efficiency

Native and drought-tolerant plants were selected for the living roof and other landscaping zones, minimizing the need for irrigation. Inside the building, potable water usage is reduced through the use of low-flow fixtures and reclaimed water where appropriate.

Energy and Atmosphere

Technologies employed throughout the building work together to reduce energy consumption by about 35 percent. In addition, up to 10 percent of the Academy's energy is produced on-site with photovoltaic cells.

Materials and Resources

When the old Academy buildings were torn down in 2005, more than 22,000 tons of construction waste were diverted away from landfills. The impact of the new building's construction was further reduced by selecting locally manufactured supplies, and steel, concrete and insulation made with recycled content.

Indoor Environmental Quality

More than 90% of the Academy's regularly occupied spaces have access to daylight and outside views. As part of the natural ventilation system, motorized windows automatically open and shut to allow cool air into the building.

Innovation in Design Process

In this category, LEED applicants can gain recognition for innovations not explicitly addressed in the categories listed above. The Academy's innovation points included one for its green building education elements—through signage, exhibits, and outreach, the Academy's LEED Platinum features are on display, not hidden away behind the scenes. The aquarium garnered an additional point for filling its saltwater tanks with water pumped in from Ocean Beach, reducing the use of potable water.

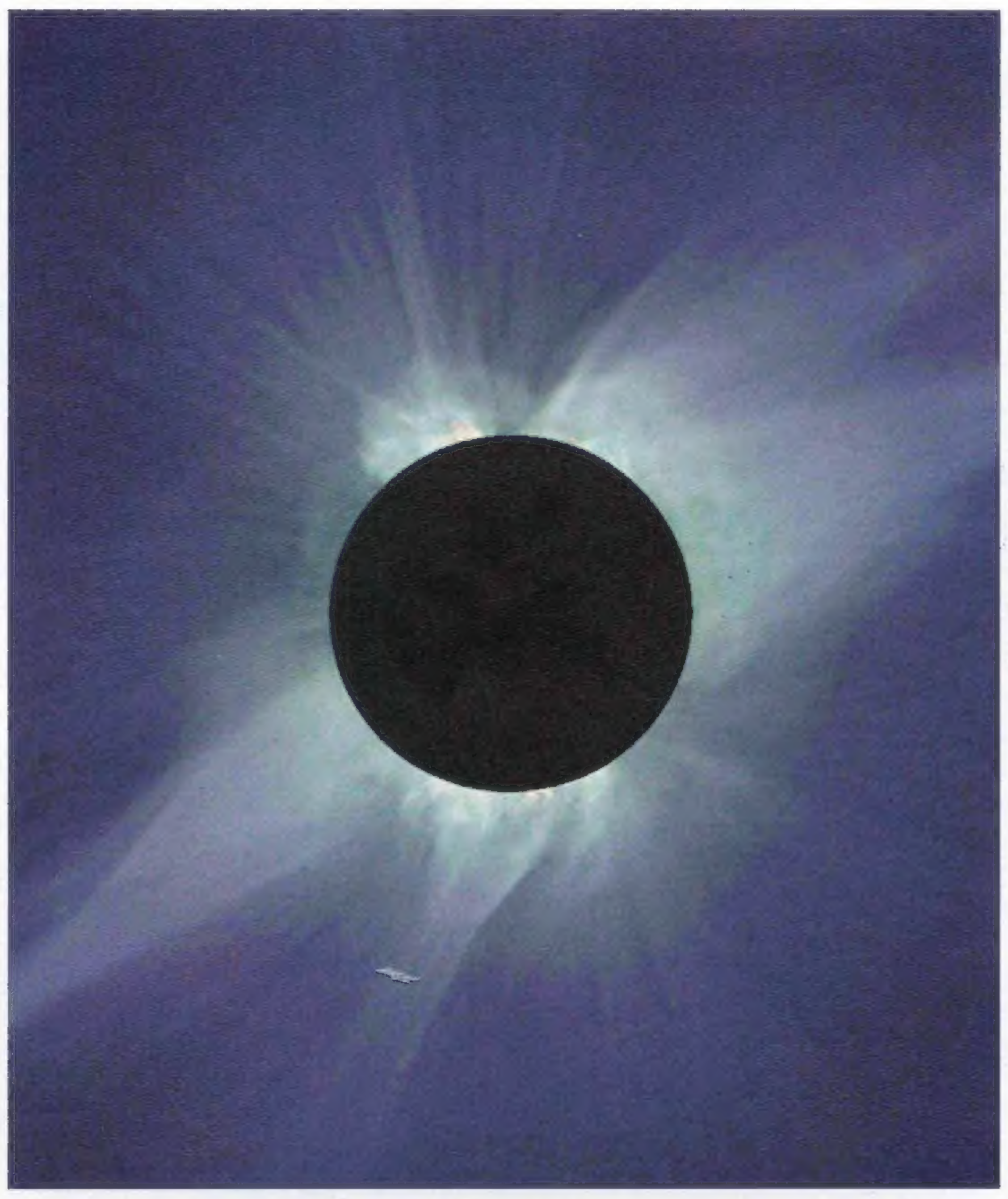
According to the U.S. Green Building Council, as of September 2008, more than 1,700 projects had been LEED certified at some level—projects in all 50 states and 69 countries around the world.

Perfectly Aligned: Viewing the Solar Eclipse in China

BING QUOCK, ASSISTANT Director of the Academy's Morrison Planetarium, has spent a lifetime reading the stars and helping others do the same. Since 1982, he has produced an astronomical number of shows for Planetarium visitors. He's taught and led stargazing nights locally, published a children's book, and created sky-watching guides for newspapers nationwide. But there's one thing he's never done: He has never witnessed a total solar eclipse.

This July, Quock will get his chance when he leads a group of Academy members to China to observe the longest solar eclipse in this century. "The maximum possible period of totality – in which the moon completely blocks the sun's disk – is seven minutes," Quock explains. "Conditions permitting, we will experience six minutes, 39 seconds."

On Wednesday, July 22, the total eclipse will follow a narrow path across half the Earth, crossing India, Nepal, Bangladesh, Bhutan, Myanmar, and China. A partial eclipse will travel the broader corridor of the Moon's shadow across eastern Asia, Indonesia, and the Pacific Ocean.



"Roughly every six months, the Earth, Moon and Sun come into perfect alignment, making eclipses of the sun or moon possible," Quock adds. "But over a single given location, it's quite rare. For example, in San Francisco the next total eclipse won't occur until 2045."

Using special filters, travelers on the Academy's China trip will view the spectacle from Oriental Land, a lush park of tree-lined streets and rolling lawns on the shores of Dianshan Lake outside Shanghai. "The corona is a ghostly sight," Quock says, "and we might even see some brighter planets and stars. Birds will stop their singing. Dappled light through the leaves will create a pinhole effect, casting multiple images of the eclipse onto the ground."

Celestial drama isn't the trip's only highlight. The nine-day itinerary will take the group to some of China's most dazzling cultural sights, including the Great Wall, Tiananmen Square, the former imperial palace at the Forbidden City, 13th-century Ming tombs, and hundreds of terracotta warriors from the 3rd century B.C. watching over Emperor Qin's tomb.

Quock has a personal interest in the history of star-gazing in China; a famed 13th-century astronomer shared his family name. "Traditionally, there was a lot of superstition surrounding the solar eclipse," he says. "People thought a dragon was trying to devour the Sun, so they would bang on drums and shoot arrows into the sky to frighten the dragon away. And their efforts always worked!"

In addition to formal lectures, lively discussions will enrich the trip experience. "Like all Academy trips, this will be a group of people who have a deep curiosity about science and culture," Quock says, "and where the two meet."

See the World through a Scientist's Eyes

Join the Academy's trip to China

- Observe this century's longest total solar eclipse from the centerline of the path of totality, in a beautiful park near Shanghai.
- Experience many of China's most renowned cultural sites, from the Great Wall and the Forbidden City to the Ming Tombs and the legendary terracotta warriors of Xian.
- Explore Shanghai's famed river-front Bund, and learn about this city's remarkable history.
- Continue your trip with an optional three-day river cruise through the famed Three Gorges.

Trip Details

Destination: Solar Eclipse Over China

Dates: July 15-24, 2009

Guide: Academy Astronomer Bing Quock

Cost: From $3,895 (based on double occupancy plus airfare)

Upcoming Academy Adventures

Baja: Among the Great Whales
February 14 - 21, 2009
Academy Leader: Chrissy Piotrowski

Amazon Voyage
March 27 - April 5, 2009
Academy Leaders: Tom Daniel and Mary Butterwick

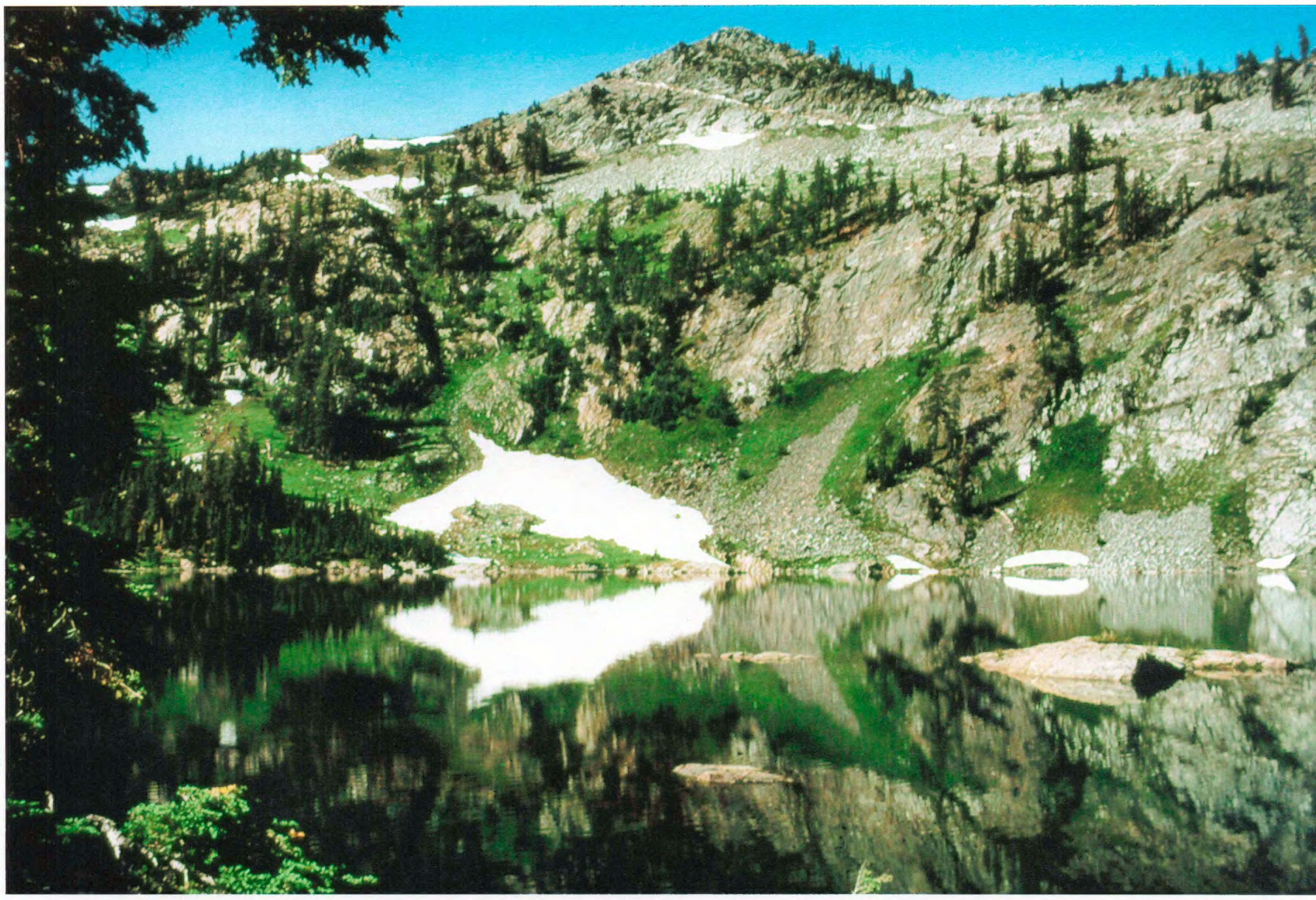
New Zealand's Natural Wonders
April 3 - 16, 2009
Academy Leaders: Bob and Gail Drewes

To learn more about upcoming Academy travel opportunities, please visit www.calacademy.org/events/travel, call 800.853.9372, or email calacademy@hcptravel.com.

Academy entomologist Dave Kavanaugh never intended to embark on a climate change study this past summer. But the beetles he's been observing and documenting for more than 40 years left him little choice.

Beetles on the Rise

BY STEPHANIE STONE



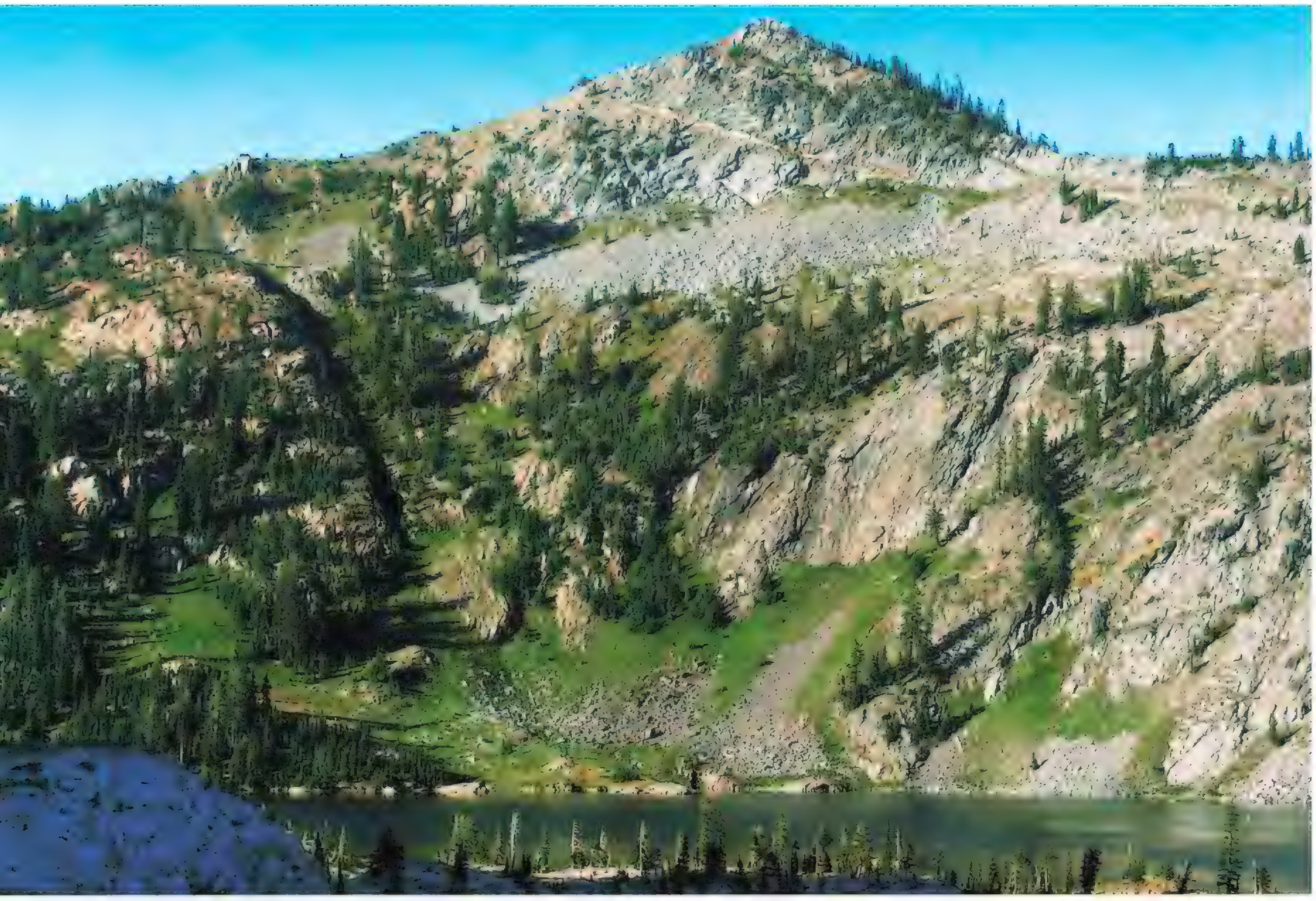
August 12, 1980: The southwest shore of Upper Caribou Lake in the Trinity Alps once hosted a permanent snowfield that was home to hundreds of *Nebria turmaduodecima* beetles.

IN THE SUMMER OF 1968, Dave Kavanaugh set off on a hike that would change the course of his life. As a second-year medical student at the University of Colorado, he had joined a climbing club with a few members of the biophysics department, and the group had set their sights on Gray's Peak—the ninth highest mountain in Colorado. Kavanaugh, who has never been able to do anything slowly, scampered up to the top of the peak in record time and sat down to wait for the rest of the group. As he peeled an orange and gazed out at the surrounding terrain, a sudden movement caught his eye. A small black beetle had crawled up onto his boot. While most climbers would have ignored (or possibly squashed) the small intruder, Kavanaugh whipped a collecting vial out of his pack—beetle collecting had been a hobby ever since he took an elective entomology course in college—and scooped up the rare specimen. He had never seen it before in Colorado, and as he learned when he got back to campus, neither had many others. There were only two previous records of the species in the state. "That was it," says Kavanaugh with a grin. "I was hooked."

THE NEXT YEAR, HE left the medical field to pursue a career in entomology. After earning a Master's degree from the University of Colorado, he enrolled in a Ph.D. program at the University of Alberta. Selecting a specialty was easy—he chose to focus on beetles in the genus *Nebria* because, as Kavanaugh says, "they live where I like to be—up in the mountains." Over the next few years, Kavanaugh scoured mountainsides from Washington to Wyoming and beyond in search of *Nebria* beetles. During the summer of 1971, he lived in a professor's camper, logging over 25,000 miles and collecting beetles from more than 400 different sites. By the late 1970s, he had exhausted all of the vehicle-accessible options and began backpacking into more remote regions, including Oregon's Wallowa Mountains and the Queen Charlotte Islands. When he arrived at the Academy in 1978, Kavanaugh was already the world's foremost expert on North American *Nebria* beetles.

MOSTLY MOUNTAIN dwellers, *Nebria* beetles are perfectly adapted for a life in frigid climates. Enzymes in their bodies have evolved to function at very low temperatures, allowing them to stay active when other animals would shut down. The beetles also produce a chemical that works like antifreeze to lower the freezing point of water, preventing their bodies from freezing solid even in subzero winter weather. During the day, these cold-adapted creatures stay safe from predators—and the heat of the sun—by hiding under rocks. At night, they emerge from their hideouts and crawl onto nearby snowfields and glaciers to feed on other insects that have been stranded on the snow. Many scientists might have preferred a study subject adapted to slightly warmer climates, but Kavanaugh seems to be

Previous spread photos: Olivier Laude, (left), Sharon Beals, (right).



August 12, 2007: The snowfield at Upper Caribou Lake now disappears each year over the summer. *Nebria turmaduodecima* beetles are no longer found at this site.

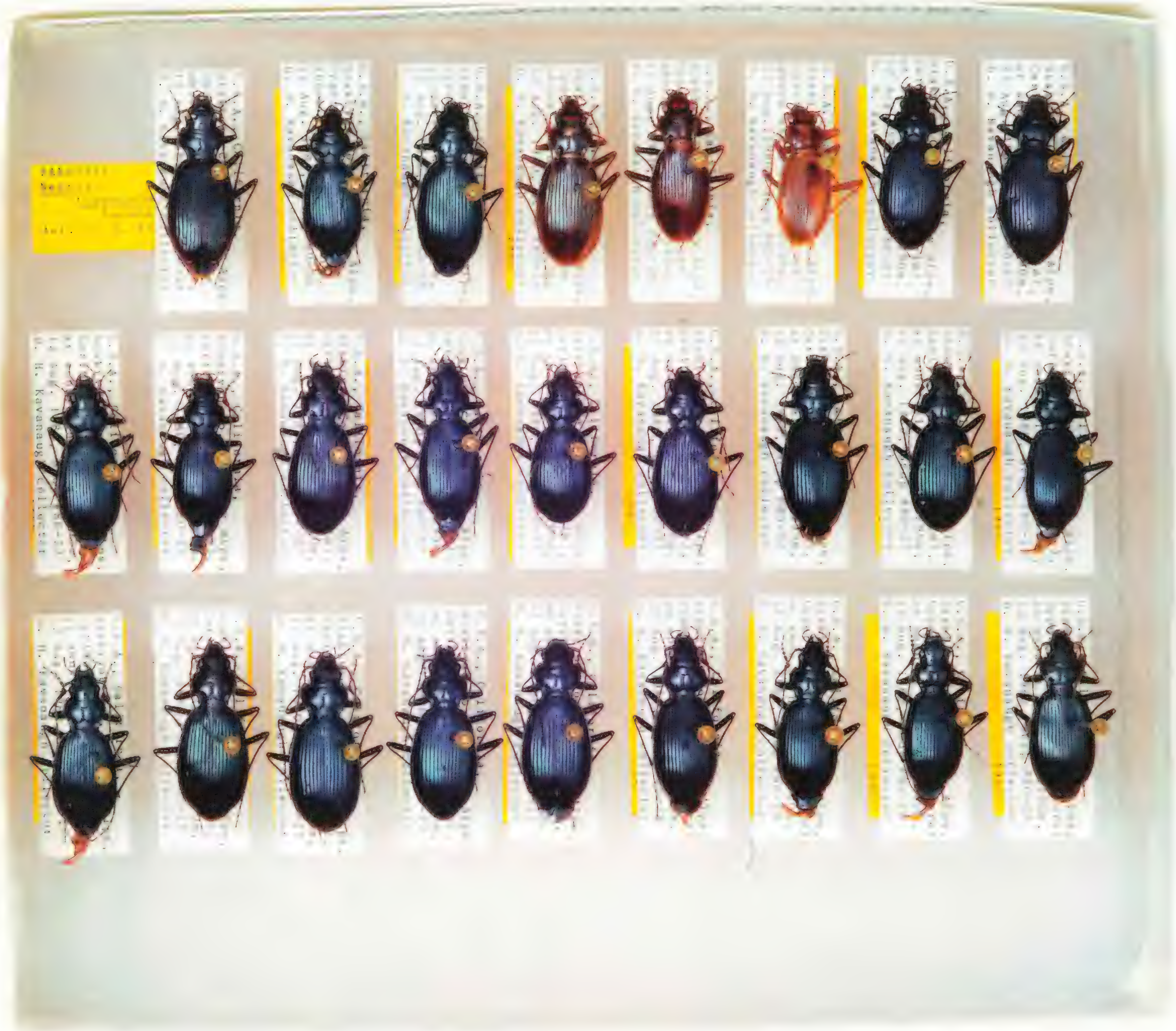
just as comfortable in the cold as his beetles. "Fifteen below is actually pretty nice," he laughs. "It's 50 below that you want to avoid." After many months in the mountains over the course of his career, Kavanaugh has documented 85 North American species of *Nebria* beetles, 43 of which were new species that he named and described.

When Kavanaugh first started collecting beetles, DNA sequencing work was barely in its infancy—the practice did not begin to pick up steam until after the Human Genome Project was launched in the late 1980s. Once DNA sequencing became an affordable tool for evolutionary biologists and taxonomists, it changed the science of specimen collection and storage. Most entomology specimens had historically been pinned and stored in drawers, making it easy to measure and compare specimens. However, in order for insect specimens to yield valuable DNA data, they must be stored in alcohol or another preservative. To get the most possible information about a particular species, entomologists now need to prepare specimens both ways.

By the time the Academy moved into its new home in Golden Gate Park in 2008, Kavanaugh had the largest and most comprehensive collection of dry, pinned *Nebria* beetles anywhere in North America, but he was missing DNA samples for a number of the species he collected early in his career. And so it was that more than 30 years after his first major cross-country quest for *Nebria* beetles, Kavanaugh set off on another epic adventure, retracing his steps in search of DNA samples for each of the species in his collection. Between June 22 and August 20 of 2008, he revisited 67 collecting sites in the mountains of eight different states. He had dutifully written down the exact location of every specimen he ever collected, so he knew exactly where to look. The problem was that the beetles were no longer there.

I have a whole new perspective on change now," says Kavanaugh as he sits in his office a few months later. "I was completely unprepared for the amount these habitats had changed in the past few decades. In some places, I found that the picturesque mountain stream I remembered was now a ski resort. Perhaps more startling, I realized that in many areas the tree-line was moving up the mountain and the glaciers were retreating." Because of their snowfield hunting practices, most *Nebria* beetles live above the tree-line, favoring barren rocky patches where they can run without wading through tall grasses or shrubs. However, the altitudes that once provided them with ideal rocky habitats now often host lush forests or meadows—and the open snowfields that were once extensive are now often gone.

Kavanaugh's first stop on his DNA mission was Sonora Pass in the Sierra Nevada range. In 1981, he had described a new species from the site, which he named *Nebria sonorae*. The next year, he collected dozens of these beetles from a stream bed at an altitude of 9,025



After collecting these specimens in August of 1980, Kavanaugh used them as the basis for describing a new species, *Nebria turmaduodecima*.

feet. However, when he returned to the exact spot in June of 2008, he couldn't find a single specimen. With the light fading, he didn't have time to hike up higher, but he vowed to return and continue his quest. Two months later, Kavanaugh made a second trip to Sonora Pass, starting his search at 9,025 feet and working his way up the mountain. "I turned over every single rock along the stream on the way up," says Kavanaugh. "I found a lot of other things, but no *Nebria sonorae*." After hiking all day, Kavanaugh had finally decided it was time to turn around when he got to the base of a small waterfall. There, at an altitude of 9,250 feet, he found 11 *Nebria sonorae* beetles that had washed down the stream and accumulated at the base of the falls. "These guys were more than 200 feet higher than they were back in 1982, and their actual habitat was probably much further up the mountain," says Kavanaugh.

AS HE TRAVELED to collecting sites in Oregon and Colorado, Kavanaugh realized that his Sonora Pass experience was not an isolated incident—it was part of a trend. In 1983, he collected specimens of two new species—*Nebria wallowae* and *Nebria labontei*—near Glacier Lake in Oregon's Wallowa Mountains. Both were collected between 6,500 and 6,700 feet. When he returned in August of 2008, he had to hike to an altitude of nearly 8,150 feet before he found them. On Quandary Peak, in Colorado's Rocky Mountains, he collected

Nebria suturalis beetles at altitudes as low as 11,700 feet in 1968. In August of 2008, he hiked as high as 12,400 feet but could not find a single specimen. He had to go to neighboring Mt. Evans, to heights of 13,100 feet and above, before he finally found *Nebria suturalis* again.

CLOSER TO HOME, Kavanaugh found more startling data in the Trinity Alps, a few hours north of San Francisco. In August of 1980, while leading a Boy Scouts trip for his son's troop, he had collected a new species, later named *Nebria turmaduodecima*, on a large snowfield near Upper Caribou Lake at elevations between 6,900 and 7,500 feet. This August, the snowfield at Upper Caribou Lake was nonexistent. Kavanaugh asked one of his graduate students, Sean Schoville, to visit nearby Thompson Peak to see if the species might still exist at higher altitudes. Schoville was indeed able to find *Nebria turmaduodecima* at an elevation of just over 7,900 feet. However, the glacier on the north face of Thompson peak, which was once one of the largest glaciers in California, is now calving. If the glacier breaks up and recedes, the winter snow accumulation will melt more quickly in future years, perhaps eliminating the last remaining habitat for *Nebria turmaduodecima*.

DURING THE LAST ICE Age, *Nebria* beetles were much more widespread. As the climate gradually warmed, they moved higher up into the mountains and populations became increasingly isolated from one another. Although their range is now much smaller than it once was, these tough predators have survived a great deal of change. However, they may now be running out of room to move. "Some of the things I saw this summer shocked me," says Kavanaugh. "Perhaps it can't all be blamed on climate change. It's possible that some of the forestation I witnessed was part of a natural forest cycle. But there's no question that the beetles are moving higher up the mountains. And where I used to find hundreds of them, I'm often now finding just a handful—or none at all."

KAVANAUGH HAS received funding from the United States Fish and Wildlife Service to continue documenting the shifting ranges of four different species of *Nebria* beetles. He will also begin to analyze the DNA from the samples he collected this summer, confirming—and possibly adjusting—the evolutionary relationships he has hypothesized based on decades of dissection and microscope work. As the beetles' habitat continues to shrink, these specimens, and the data they hold, are now all the more important to future generations of scientists.

Q&A with Dave Kavanaugh

Q: You have named and described over 70 new species of beetles so far. Do you have a favorite?

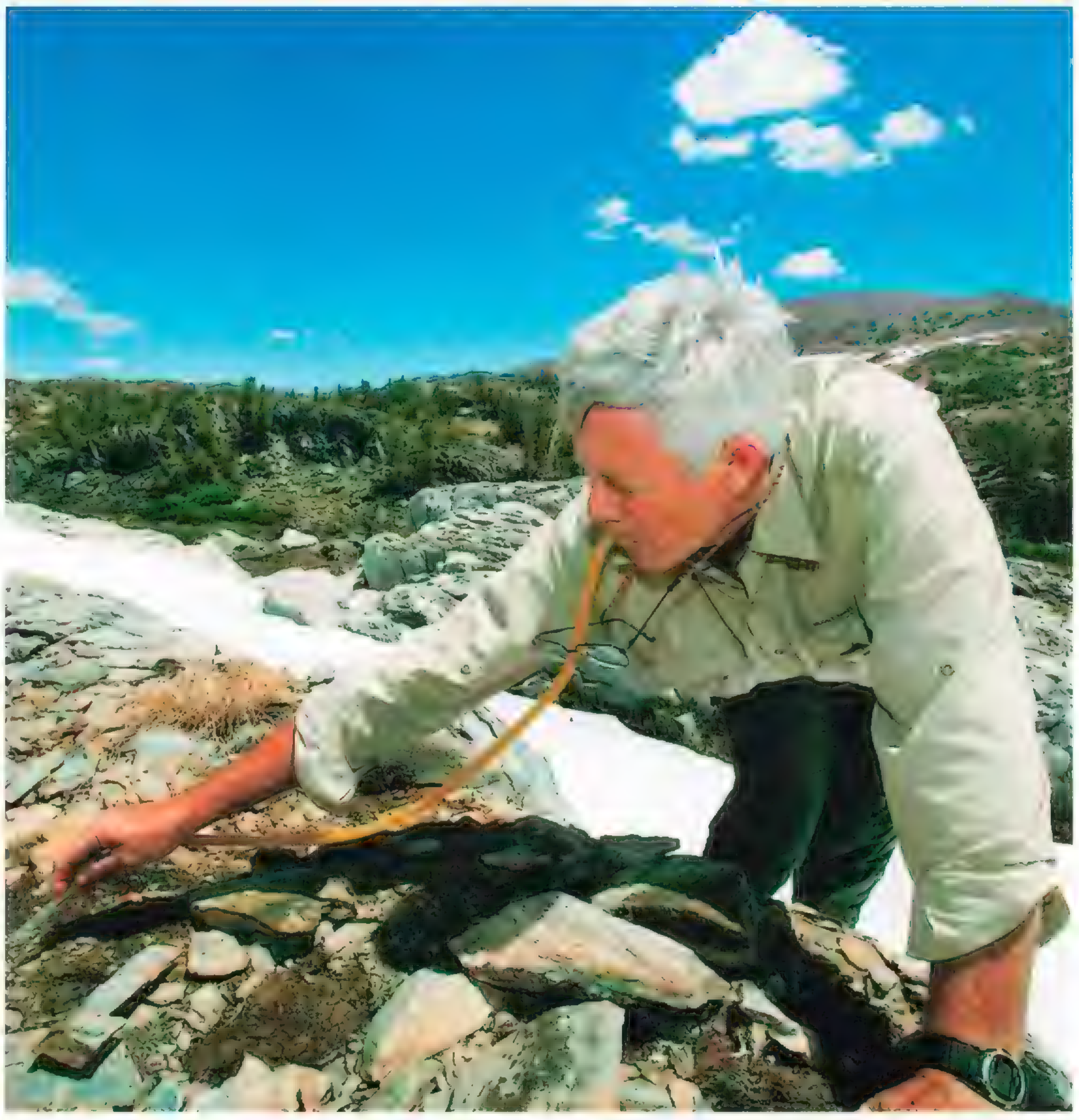
A: That's a tough question because they're all special in their own way. Perhaps my favorite is *Nebria beverlianna*, a species that I named in honor of my wife. Adults of this species are large, a beautiful metallic bluish-purple in color, and have long chains of bumps sculpted on their wing covers. Finding such a conspicuous new species in western Wyoming was a great surprise.

Q: What is the most remote location you've traveled in search of beetles? Are there other places you're still hoping to visit?

A: Probably the most remote spot I've been to collect was the Finnisterre Mountains in Papua New Guinea. We had a flight by small plane to a remote airstrip carved out of forest on a mountain slope, then a three-day walk to the site we wanted to visit. It felt so far from home. I've never been to the Alps in Europe and would like to see alive the *Nebria* that live there.

Q: Did your research this summer change your perspective on climate change?

A: Absolutely. Many of the changes I found this past summer in the distributions of the species I've studied for over 40 years can have no other cause, and the reality and consequences of climate change have hit me like never before. If the current warming trends continue, some of these species surely will go extinct in this decade, and at least one of them may be gone already. I wasn't prepared for this realization.

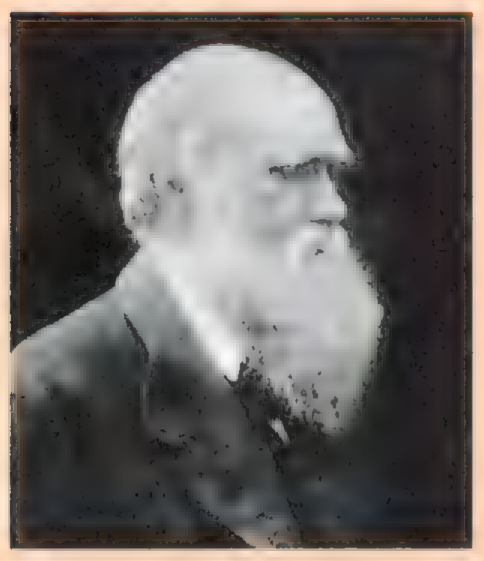


Kavanaugh, shown here in Tioga Pass in the Sierra Nevada range, uses a tool called a pooter to collect small beetles that are difficult to handle.

Photo: Dong Lin

Live at the Academy

EVOLVE 2009 LECTURES



The Academy presents the following lectures as part of Evolve 2009, a San Francisco celebration of evolution in honor of the 200th anniversary of Charles Darwin's birth and the 150th anniversary of the publication of *On the Origin of Species*. Additional Evolve programs will take place in March of 2009.

Location: California Academy of Sciences
Price: Free for members, non-member pricing available at www.calacademy.org/events.
Note: Seating is limited. Online ticketing and RSVP information will be available soon at www.calacademy.org/events.

Pritzker Lecture

Applications and Influence of Evolution: A Wide Spectrum
Tuesday, February 10, 2009
12:15 and 6:30 pm
David Mindell, Ph.D.
Dean of Science and Research Collections, California Academy of Sciences

Dr. Mindell will discuss the broad applications of evolutionary science, from public health to forensics to conservation, based in part on his recent book, *The Evolving World*. Learn how evolution has grown from an unpopular curiosity to a set of concepts that are useful to society.

Pritzker Lecture

The Young Charles Darwin: Where Did He Get His Ideas?
Thursday, February 12, 2009, 12:15 pm
Keith Thomson Ph.D.
Professor Emeritus of Natural History, University of Oxford, and Senior Research Fellow, American Philosophical Society

How and when did Darwin actually form his revolutionary ideas? How did a quiet 27-year-old, who had been isolated for five years on a voyage around the world, develop the most provocative idea of the past 200 years? The concept of natural selection did not suddenly come to him one day in the bath (the way Archimedes supposedly discovered the phenomenon of specific gravity). In this lecture, find out how Darwin created his theory during a period of intellectual and social turmoil.

Note: Thomson will also give an informal presentation, entitled "Who was Charles Darwin?", at 7:00 pm as part of the Academy's NightLife program.

Darwin Series

Patagonia and the Pampas: Darwin in Southern South America
Tuesday, February 17, 2009, 12:15 pm
Gary Williams, Ph.D.
Curator, Invertebrate Zoology & Geology, California Academy of Sciences

More than half of Charles Darwin's book, *The Voyage of the Beagle*, refers to southern South America. From 1832 to 1835, Darwin traveled extensively in the Pampas and Patagonia. Williams will present a natural history of the region based on his own travel excursions over two decades, which follow Darwin's historic travels.

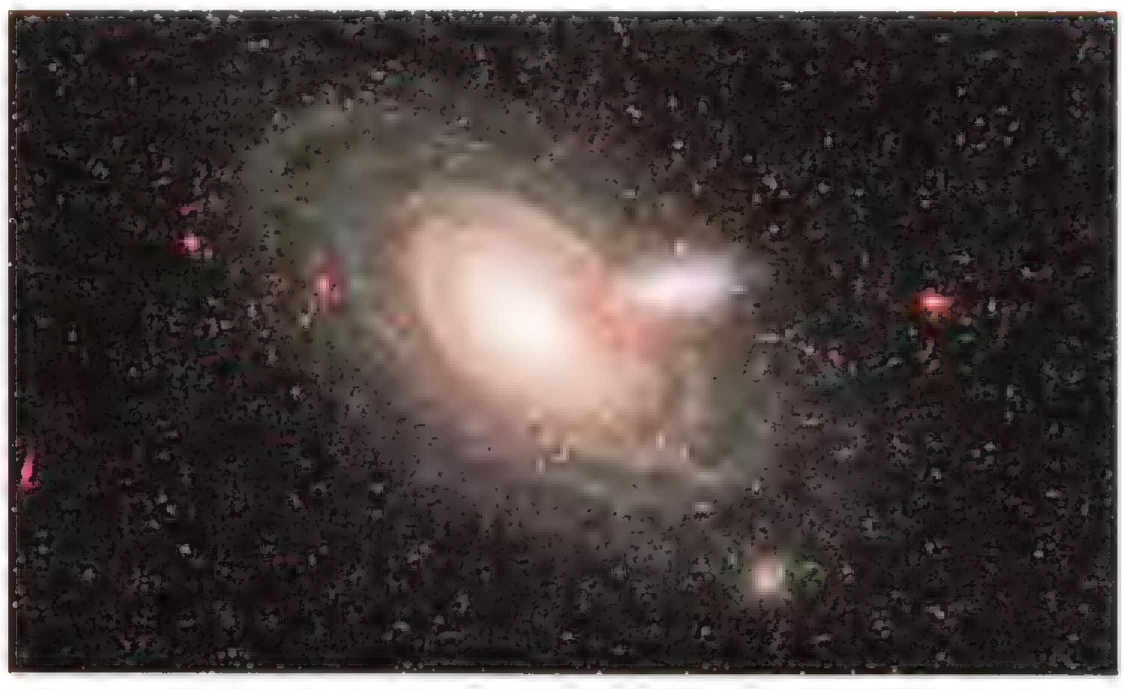
Darwin Series

Leaping Lizards! Charles Darwin Explores the Galápagos
Tuesday, February 24, 2009, 12:15 pm
Terrence Gosliner, Ph.D.
Curator, Invertebrate Zoology & Geology, California Academy of Sciences

During this talk, Gosliner will provide an accurate portrayal of how Darwin's visit to the Galápagos shaped his ideas on evolution by means of natural selection. Popular mythology has distorted Darwin's immediate impressions of the Galápagos and their role in shaping his ideas about evolution. The Galápagos were an important influence, but not in the way depicted in most biology textbooks and popular culture.

NightLife

Every Thursday night from
February 12 - October 29, 2009
6:00 - 10:00 pm



Beginning February 12, 2009, each Thursday evening at the Academy will be filled with provocative science, music, mingling, and cocktails as visitors get a chance to explore a section of the museum at night. Activities will vary each week, including star-gazing, science cafes, science-related art shows, opportunities to meet aquarium critters, and much more.

On February 12, help launch NightLife and Evolve 2009 at the same time. Evolve 2009 is San Francisco's city-wide celebration of evolution and the Darwin anniversaries. At 7:00 pm, Keith Thomson of the University of Oxford will present an informal talk, "Who was Charles Darwin?"

NightLife admission: $10 non-members, $8 members.
Information: To be placed on the NightLife email list, contact nightlife@calacademy.org.

The Art of Conservation

Presented in association with Conservation International and the Institute at the Golden Gate
Tuesday, February 3, 2009
6:30 - 8:00 pm
Frans Lanting, Frans Lanting Gallery
Cristina Mittermeier, Executive Director, International League of Conservation Photographers

Many dramatic effects of climate change are in remote places that most people will never see. A new book and exhibition by Conservation International and the International League of Conservation

Photographers attempts to bring these places to life, pairing stunning photographs with essays by leading thinkers on such topics as renewable energy, the human dimensions of climate change, and polar melting. The speakers will discuss their explorations of exotic and threatened places and the art of capturing these places in a symbolic way for the entire world to appreciate.

Location: Hearst Forum, California Academy of Sciences
Price: Free. Seats are limited. To reserve a seat, RSVP to (415) 765-4415 or norcal_events@ntrs.com.

Conversations at the Herbst Theatre

Monday, January 26
Adam Gopnik, Author, Essayist
In conversation with Roy Eisenhardt
Angels and Ages: A Short Book about Darwin, Lincoln and Modern Life, Paris to the Moon, Through the Children's Gate

Wednesday, February 18
Terry Tempest Williams, Author, Naturalist
Finding Beauty in a Broken World, Open Space of Democracy, Passion and Patience in the Desert

Location: Herbst Theatre, 401 Van Ness Avenue, San Francisco
Time: All programs begin at 8:00 pm
Price: $18 members, $20 non-members; purchase series tickets for $96 members, $108 non-members
Tickets: Call City Box Office at (415) 392-4400 or visit www.cityboxoffice.com. The Academy does not process ticket orders for these lectures.

This series is presented by City Arts & Lectures, Inc. It is made possible, in part, by a grant from the Richard and Rhoda Goldman Fund, the Myers Family Fund, and the Lilienthal Family Fund.

Benjamin Dean Astronomy Lecture Series

The December 2008 lecture is the last to take place at the JCC. Starting January 2009, Dean Lectures will return to Morrison Planetarium for the 20th anniversary of the lecture series. To take advantage of the planetarium's immersive capabilities, Academy staff will work with individual speakers to produce fulldome video sequences for their lectures.

Seating is limited. Purchase tickets by calling (415) 379-8000.
Time: All programs begin at 7:30 pm
Questions: Email deanseries@calacademy.org or call (415) 379-8000

The MESSENGER Mission to Mercury

Monday, December 15
Robert Gold, Ph.D.
Applied Physics Laboratory, Johns Hopkins University

The MESSENGER spacecraft is on its way to orbit Mercury, a planet of extremes. Mercury has the greatest temperature variation, the highest density, and the most Earth-like magnetosphere of any planet. Until recently, very little was known about Mercury because it is difficult to observe and study. MESSENGER has now flown by the planet twice, revealing new information about its structure and the geological processes that have shaped it. This lecture will cover the challenges of developing a spacecraft to deal with Mercury's extreme environment, and show some of the amazing scientific results from the MESSENGER flybys.

Location: Kanbar Hall at the Jewish Community Center, 3200 California Street (at Presidio Avenue), San Francisco
Price: $5

Dark Energy and the Runaway Universe Presented by the Fellows of the California Academy of Sciences

Monday, January 12
Alex Filippenko, Ph.D.
University of California, Berkeley

Observations of very distant exploding stars (supernovae) show that the expansion of the Universe is now speeding up, rather than slowing down as expected. Other, completely independent data strongly support this amazing conclusion. Over the largest distances, the Universe seems to be dominated by a repulsive "dark energy," stretching the very fabric of space faster and faster with time. The physical nature of dark energy is often considered to be the most important unsolved problem in physics, and it will probably provide clues to a unified quantum theory of gravity.

Location: Morrison Planetarium, California Academy of Sciences
Price: $5 for members, $10 non-member adults, $8 non-member seniors

Asteroids, Evolution, and the Long-term Habitability of Earth Presented by the Fellows of the California Academy of Sciences

Monday, February 2
David Morrison, Ph.D.
NASA Ames Research Center

Cosmic impacts are now recognized as a major factor in the biological history of the Earth. Most dramatic was the discovery that a cosmic impact caused the mass extinction 65 million years ago at the end of the Cretaceous. Now that scientists recognize the importance of impacts, they can consider ways to protect the planet from future cosmic disasters. The first step is the Spaceguard Survey, which looks for and characterizes potentially threatening near-Earth asteroids. Scientists are also studying technologies that could deflect impactors before they hit. For the first time in history, humans have the capacity to predict, and perhaps avoid entirely, the sort of catastrophe that wiped out the dinosaurs.

Location: Morrison Planetarium, California Academy of Sciences
Price: $5 for members, $10 non-member adults, $8 non-member seniors

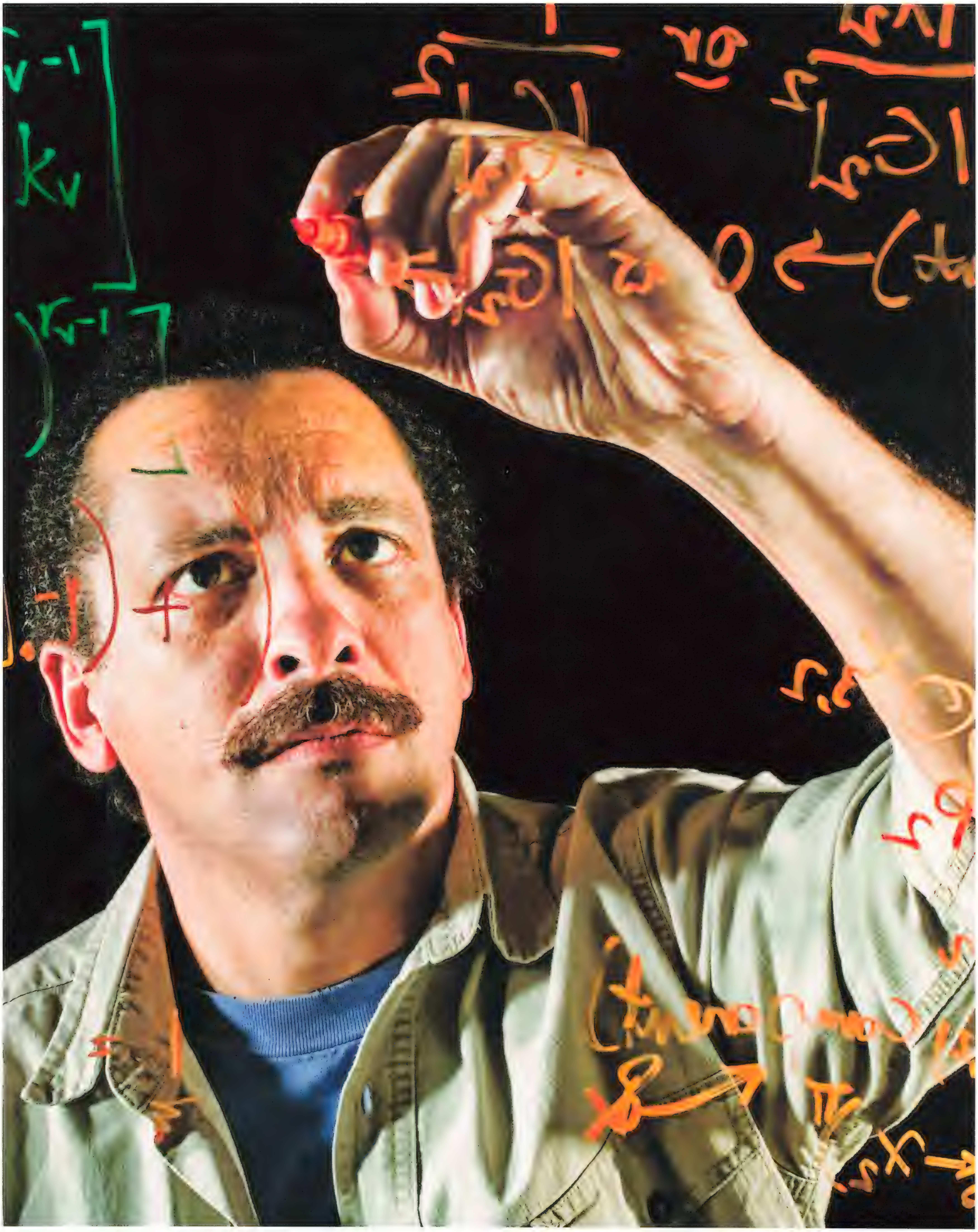


Photo: Olivier Laude

ALTERED STATE

An Academy paleontologist shifts the focus of his career to address the current climate change crisis.

BY ANDREW NG

On August 8, 2008, Academy scientist Dr. Peter Roopnarine and Professor Geerat Vermeij of the University of California, Davis, published a paper in *Science* entitled "The Coming Arctic Invasion." In the paper, they predicted that melting ice in the Arctic Ocean, due to global climate change, would open a corridor for Pacific shellfish to invade the Atlantic (see sidebar for details). To the scientists' surprise, their findings were reported in two dozen news outlets across the world, ranging from Canada all the way to Pakistan and India. Perhaps even more surprising were the 100-plus comments that appeared on various blogs and websites. The responses ranged from detailed, mathematical questions to hostile comments accusing the scientists of being communists and purveyors of fraud.

Why does the topic of climate change elicit such extreme responses? What can scientists do to rectify misconceptions about their research? In the following pages, Roopnarine discusses the reactions to his paper, the research he conducts at the Academy, and what will happen 50 years from now if humans do nothing about global climate change.

AN: Your research encompasses a lot of topics. What are your specialties?

Peter Roopnarine: For a long time, I studied the marine communities, especially of mollusks, that lived in tropical America between 35 million years ago and the present. Now, more generally, I study extinction events in the fossil record. I look at how ecosystems evolved in response to such events. I am also working to predict how communities may react to future climate-induced shifts in their habitats.

How does your work on past extinctions apply to the current climate change crisis?

Life on Earth is undergoing a mass extinction right now, and it's due to human activity. While this is the first time that humans have induced a major shift in climate, it's not the first time our planet has experienced a major climate change event. For the past 150 years, paleontologists have been studying climate change as part of their work in reconstructing past environments. Only now are we realizing how relevant it is to our current situation. By looking at the ways in which communities reacted to catastrophes and extinction events in the past, we can predict how they may

Dr. Peter Roopnarine uses the glass wall of his office to work on his math-based extinction model.

DOING THINGS DIFFERENTLY
CREATING MARINE PROTECTED AREAS
WHAT ARE OTHER COUNTRIES DOING?

Roopnarine served as lead curator for the exhibit *Altered State: Climate Change in California.*

> "Climate change is the largest and most significant problem that we will face in the foreseeable future. It's something we should all care about, because we stand to lose a lot."
>
> -PETER ROOPNARINE

react in the future. As climate patterns change, species will either die off or move to new homes in order to survive. Predators will encounter new prey. Plants may no longer have pollinators. These are things that have happened before, so we have a model for what may happen next.

When did the realization hit that you could apply your research to the current climate change crisis?
In 2003, I attended a week-long conference in Japan entitled "Extinction." It was a gathering of 70 scientists from many different fields: paleontologists, population ecologists, theoretical ecologists, conservation biologists. It became clear during the conference that habitat destruction and other activities were operating at a much smaller scale than climate change. Also, the media stories about that conference emphasized how critical the climate change issue was. I decided then that I would shift the focus of my research to extinction, conservation, and climate change.

What were the responses to your recent *Science* paper ("The Coming Arctic Invasion")?
I received a few unfriendly emails and some detailed comments on my Academy blog (www.calacademy.org/blogs). More than 100 posts also appeared on other blogs and websites. On the one hand were the skeptics, who asked why I thought the Atlantic invasion would be "harmful." I actually never said that in the paper. On the other hand were those asking why I thought it would be "beneficial." I never said that either. It just shows that one should actually read the paper before commenting on it.

One amusing comment I read was: "I'll happily keep my SUV chugging if it means more shellfish on the table!"

On a scale of 1-10, how certain are you that climate change is happening?
Ten.

How certain are you that humans are causing climate change?
Ten.

How certain is the scientific community as a whole?
I'd say nine and a half. The United Nations's Intergovernmental Panel on Climate Change (IPCC) keeps track of the consensus in the scientific community.

Why do there seem to be mixed messages in the popular media about climate change: whether it's real or not, whether it's human-induced or not?
I believe there are two reasons: 1) It's a very difficult topic from a scientific standpoint, so there are issues with communicating and understanding the science. 2) It's a very sensitive topic—it's a heavy guilt trip to lay on ourselves.

What can I do as an average citizen/consumer to mitigate climate change?
Learn about the impact of everyday human activities and evaluate your lifestyle. Identify which one plays the biggest role in your life and change it. For many Americans, this probably means transportation. The Academy's climate change exhibit, *Altered State*, has a section called the "Arena for Engagement" that allows visitors to evaluate their lifestyles and think of alternatives.

Photo: Chris Picon

What can I do as a citizen who has time on my hands?
Become involved in education and community activities, such as the Academy's docent program. Qualify yourself to spread the word.

What can I do as a budding scientist?
Realize that you will be diving into the largest problem that human civilization has ever faced, and one of the most challenging problems that science has ever faced. Working in climate change science will bring you very close to the public.

How about as a child?
Learn to be environmentally conscious at an early age. For example, turn off the tap when brushing your teeth, and watch less TV.

And finally, as a teacher?
Teachers can lead the way in inspiring children—their impact grows as the child grows. They should also temper the gravity of the problem so that there's some sense of hope.

When was the last time global climate change occurred? What caused it?
Ten thousand years ago, as we emerged from the last Ice Age and the glaciers retreated. That was caused by natural variation in the Earth's orbit.

This year alone, we experienced intense thunderstorms in the southern U.S. (February), tornadoes and flooding in the Midwest (spring and summer), a devastating cyclone in Myanmar (May), and killer Hurricanes Gustav and Ike (late summer). Can we attribute any or all of these to global climate change?
I think we can. The scientific community is very careful and responsible in drawing connections. We ask: Is this part of normal long-term variation, or an actual change in regime? There's no definite answer yet, but I personally think the latter. I'd be happy to be wrong.

Can you envision what the world will be like 50 years from now, if we do nothing?
Sea levels will be higher, and productivity will decline in the oceans. Biodiversity will decline in many regions of the world. I want to clarify that it's not the warming that will be harmful, but rather the change. To survive disruptive change, species must either migrate to refuges (which are becoming rare on Earth), or evolve. Climate change is happening too fast for species to evolve.

For humans, it will be a far less secure world. We will have issues with energy and food supplies. Higher sea levels will impact coastal communities. The U.S. will probably see a decline in economics and increased domestic problems.

Despite all this, you remain very optimistic about the future. Why?
As a parent of a young daughter, I don't think I can afford to be pessimistic. Also, I believe that humans are clever and can apply their intelligence on a large scale, both to create as well as to solve problems.

The Coming Arctic Invasion

Approximately 3.5 million years ago, the Isthmus of Panama formed and the Bering Strait opened between what is now Alaska and Russia. These geographic changes altered global ocean circulation, resulting in a brief warm period on Earth. During this period, Arctic sea ice melted and opened a corridor for animals in the north Pacific to migrate into the north Atlantic. Eventually the sea ice reformed, the Arctic corridor closed, and the migration of animals ceased.

Today the Earth is entering into another warm period, and climate models predict a nearly ice-free Arctic Ocean by the year 2050. Will this re-opened corridor allow a second invasion of animals from the Pacific into the Atlantic? To answer this question, Vermeij and Roopnarine evaluated 219 groups of mollusks in the Bering Sea—such as clams, mussels, and snails—and compared them to mollusks that had invaded in the past. Seventy-seven groups shared enough characteristics with past invaders to make them potential invaders in the future.

What does this mean for the smaller, weaker mollusks in the Atlantic, which are not expected to migrate in the reverse direction? Based on data from past invasions, Vermeij and Roopnarine do not expect a slaughter. Instead, the newcomers from the Pacific will increase the diversity and competition in north Atlantic communities.

"The composition and dynamics will change," Roopnarine says. "But whether that will help or harm local fisheries is an open question. Humans may have to adapt as well."

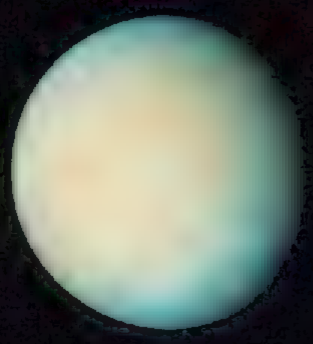
Photo: Olivier Laude

skyguide

Mercury

36 million miles from the Sun

In December, the smallest and nearest planet to the Sun is just emerging from the Sun's glare and is becoming visible in the evening sky after sunset, passing near Jupiter on December 30, but quickly looping around immediately after and plunging back into the twilight by mid-January. It climbs out of the pre-dawn twilight in late January, taking part in a spectacular clustering with Mars, Jupiter, and the waning crescent Moon on the mornings of February 22 and 23. Look also for the Moon nearby on the evening of December 28, with Jupiter nearby.



Venus

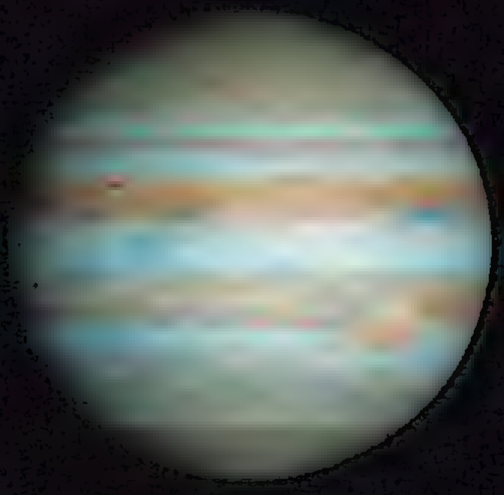
67.2 million miles from the Sun

Venus is a brilliant evening object, shining brightly in the southeast after sunset, slowly moving from the stars of Sagittarius to those of Capricornus, then Aquarius, and finally ending up in Pisces by late February. Venus passes very near the most distant planets, though they're not visible without a large telescope—Neptune on December 25 and Uranus on January 23. The Moon passes near Venus on the evenings of December 1 and 31, January 29, and nearest on February 27.

Mars

141.6 million miles from the Sun

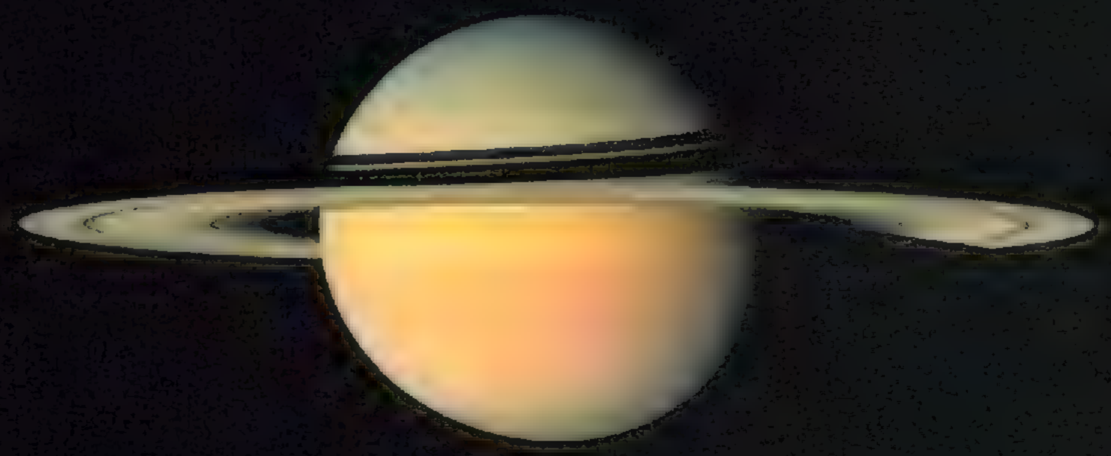
The Red Planet is at conjunction with the Sun on December 5 and washed from view by the glare of the Sun for nearly the entire season. Can you see it very low in the southeast on the morning of February 16, very close to Jupiter? It joins Jupiter, Mercury, and the Moon in a close gathering in the predawn twilight on the morning of February 22—look very low in the east-southeast, just before sunrise.



Jupiter

483.6 million miles from the Sun

Jupiter, the crescent Moon, and Venus form a very pretty trio in the southwest after sunset on December 1. The Moon swings past Jupiter again on the evenings of December 28 (with Mercury between them, but all very low and a challenge to observe), and just before dawn on February 22 (along with Mercury and Mars, though this clustering is barely above the horizon as twilight builds). The Moon's encounter with Jupiter on January 25 is too near the Sun and not visible.



Saturn

886.7 million miles from the Sun

A morning object, the Ringed Planet rises after midnight at the beginning of December and is due south at sunrise. Rising four minutes earlier each morning, it rises at midnight by late December, around 10 pm in mid-January, and about 8 pm in mid-February. The Moon passes nearby on the mornings of December 18 and January 15, and the evening of February 10.

Happy Birthday!

On December 11, astronomer Annie Jump Cannon was born in 1863. At Harvard Observatory, she made the first serious attempt to classify stars based on their temperatures. Her system is still used today, organizing stars by spectral types O, B, F, G, K, and M. (Astronomers use the mnemonic, "Oh Be a Fine Girl, Kiss Me.")

	Sunrise	Local Noon	Sunset
December 1	7:07 am PST	11:59 pm PST	4:51 pm PST
January 1	7:25 am PST	12:13 pm PST	5:01 pm PST
February 1	7:14 am PST	12:23 pm PST	5:33 pm PST

Times are for San Francisco, CA, and will vary slightly for other locations.

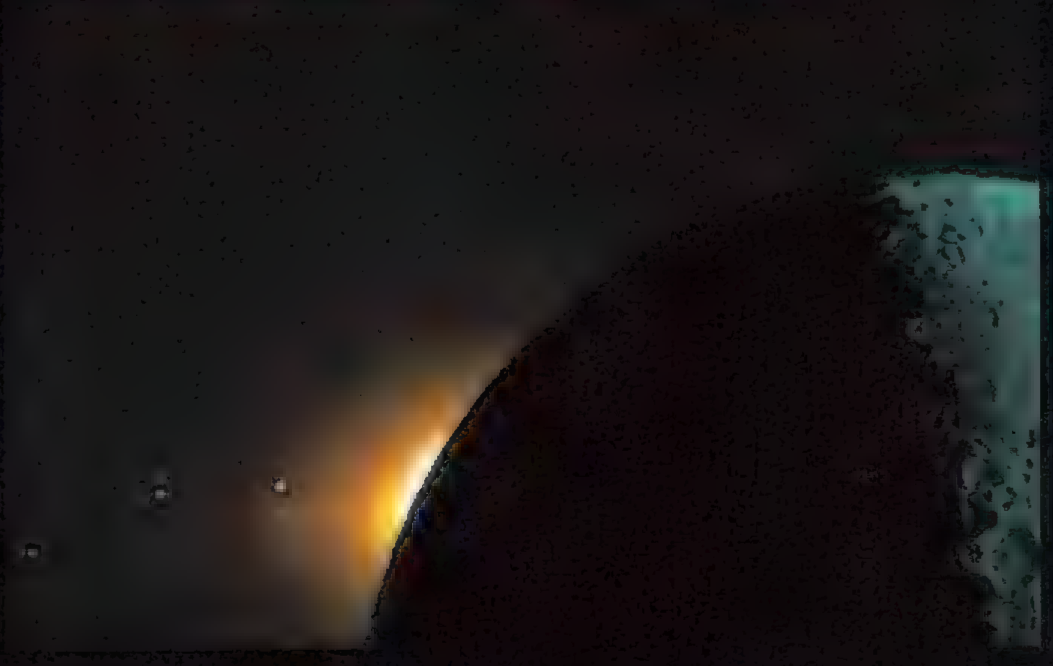
Chaos Approaches

On December 2, Kuiper Belt Object #19521, named Chaos, makes its closest approach to Earth. But don't worry—it will still be 3.8 billion miles away.

Jovian Discovery

On December 3, 1904, the moon Himalia, orbiting Jupiter, was discovered from Lick Observatory near San Jose, CA. Himalia is the largest irregular satellite of Jupiter, measuring at least 80 by 62 miles.

The Path of the Planets



This season, notice how many close encounters between the Moon and the planets occur as the Moon, changing location from night to night, approaches and passes Venus, Jupiter, Mercury, and Saturn. That's because the objects in the Solar System orbit on nearly the same plane, so as seen from Earth (which is also on that same plane), you see the Moon and planets—and would also see the Sun, if its glare weren't so bright—moving along a narrow path across the sky. It's as if a handful of marbles were rolling along a circular track on a tabletop. Since Earth orbits on the same plane (on the same tabletop), you can never view the solar system from "overhead" to see the planets' orbits forming nice, concentric rings. Instead, you look along the plane/tabletop and see the other planets moving back and forth, following a narrow path—in some cases bouncing from one side of the Sun to the other, and in others circling all the way around but nevertheless confining themselves to that narrow path. In the sky, that path is called the "ecliptic," and it's found against the stars that form the constellations of the zodiac. This is why the Sun, Moon, and planets have always been associated with the zodiac and are never seen straying from its stars.

Not Yet Retired

NASA's Cassini spacecraft flies past Saturn's moon Titan on December 21. Cassini completed its four-year mission on June 30, 2008, after taking more than 150,000 images of the ringed planet and its moons. But the spacecraft is still healthy enough for NASA to give it a two-year mission extension, including 60 more orbits of Saturn and numerous flybys of its moons.

Skywatcher's Guide (December 2008–February 2009)

December 12

Full Moon just off the tips of the horns of Taurus the Bull. During the night, it moves slowly past the official boundary of Taurus and enters the stars of Gemini the Twins. Among Native Americans, this Moon was named the "Peach Moon" by the Choctaw, the "Cold Moon" or "Long Night's Moon" by the Algonquin, and the "Chief Moon" by the Micmac.

Coinciding to within six hours of lunar perigee (the Moon's closest approach to Earth)—which is at 2 pm PST—this Moon brings higher tides than usual.

December 13

Peak of the annual **Geminid meteor shower**, generally recognized as the most reliable meteor display of the year, with 50-60 meteors per hour—but the bright light of the just-past-full Moon will obscure the view.

December 21

Winter Solstice at 4:05 a.m. Commonly regarded as the first day of Winter for the Northern Hemisphere, this is the day the Sun rises and sets at its southernmost points on the horizon and spends the least amount of time above the horizon, making for the shortest daylight period of the year. Peak of the Ursid meteor shower, a weak display that radiates from the stars of Ursa Minor, the Lesser Bear (also popularly referred to as the Little Dipper). Typically, this sparse shower produces only about five meteors per hour.

December 27

New Moon at 4:23 a.m. Visual observation of the first crescent after new marks the start of the month Muharram in the Islamic calendar, and is expected to be possible on the evening of the 28th.

January 3

Earth at perihelion, or nearest the Sun—showing that the seasons have nothing to do with Earth's distance from the Sun but rather with the angle and duration of sunlight.

January 4

Peak of the **Quadrantid Meteor Shower**, averaging up to 40 meteors per hour, radiating from the site of the defunct constellation Quadrans Muralis, which was located between the constellations Boötes the Herdsman and Draco the Dragon, and which rises in the northeast at about midnight.

January 10

Full Moon, located against the stars of Gemini, near the bright star Pollux (the brightest star known to be orbited by at least one planet). This full Moon had many Native American names that related to wintertime, among them the "Ice Moon" (Ildefonso and San Juan), the "Moon of Frost in the Teepee" (Lakota Sioux), the "Frost Fish Moon" (Micmac), the "Big Cold" (Mohawk), and the "Cold Weather Moon" (Nez Perce).

January 25

New Moon at 11:56 pm. The first crescent after new will not be visible until the evening of the 26—this will mark the start of the month Safar in the lunar-based Islamic calendar.

This new Moon moves between Earth and the Sun, causing an annular solar eclipse observable from the Indian Ocean and western Indonesia. Unlike a total solar eclipse, an annular does not cover the Sun's entire disk, so the Sun's outer atmosphere, or corona, does not become visible.

February 9

Full Moon against the stars of Leo the Lion, very near the bright star Regulus, which represents the Lion's heart. The Osage Indians named this the "Light of Day Returns Moon," and the Natchez called it the "Chestnut Moon," while the Ponca called it the "Moon When the Ducks Come Back to Hide."

A penumbral lunar eclipse occurs as the full Moon skims the very pale, outer portion of Earth's shadow. Any darkening of the lunar disk is typically so subtle that it's most easily detectable through long-exposure photography. Takes place when the full Moon is above the horizon over China, most of Russia, Australia, New Zealand, and Alaska.

February 24

New Moon at 5:36 pm. Naked-eye sighting of the first crescent after this new Moon marks the start of the month Rabi-al-Awwal in the Islamic calendar.

Q&A

Insiders Tell the Best Stories

Make new friends, but keep the old, as the song goes. Many of the Academy's most active supporters have been loyal for decades, and are now bringing new generations to come face-to-face with the natural world. Meet longtime Academy loyalists Diane Ososke and Martha Kropf.

Photo: Sharon Beals

"Lifelong learning" could be Diane Ososke's credo. Like so many members, this retired teacher first experienced the Academy as a child and now loves bringing her grandchildren to visit.

Q: You're a second-generation San Francisco native. How have your experiences at the Academy changed over the years?
A: One of my fondest early memories was walking hand-in-hand with my father and entering the Academy by the fountain with the seal sculpture, back in the 1940s. He took my brother and me there often. I loved all the fish, and African Hall, even though it was a bit scary for a little girl. I especially remember the final diorama of the African plain, which featured lighting that would change from day to night. Later I took my own children there, and still later, my grandchildren.

Q: For 30 years, you were an elementary school teacher. How did the Academy's school programs support your teaching?
A: I taught in the San Francisco school district, the longest stretch at a wonderful school on Treasure Island. Many of our students had parents in the Navy, but many also came to us from the Tenderloin via school bus. These were largely immigrant families from Vietnam and Cambodia who were just learning English. The Academy offered wonderful field trips and we went many times. The natural world is something that bridges language and culture barriers.

Q: Since your retirement, how have you continued to pursue your passion for science and teaching?
A: I serve on the Board of Trustees for the Hamlin School, which is placing a greater emphasis on teaching science to young girls. When I attended Hamlin School, the education there was more about teaching us to become ladies, but now it's really equipping girls to succeed in the world. I also belong to every museum in the City, and go to every exhibit.

Q: You've been very supportive of the Academy as an annual donor (Friends of the Academy) for many years and as an Eastwood Associate. What encouraged you to expand your support with a generous gift to the Campaign for the New Academy to name a seahorse on the Swamp railing?
A: I decided to make the Academy a beneficiary of my retirement plan in honor of my many fond memories of visiting the Academy with my family. I took advantage of the Pension Protection Act to use my IRA to make a tax-free donation to the Campaign for the New Academy. There is good news for others who want to use their IRA for charitable gifts. The act has been extended through 2009, and you can give up to $100,000 from your IRA without tax consequences. For those of us who are 70 ½ and older, it is a great chance to give to the Academy.

To learn more about the Friends of the Academy, Eastwood Associates (our council for members who have included the Academy in their estate plan), and using your IRA for charitable giving, please contact Louise Gregory at (415) 379-5407 or lgregory@calacademy.org.

Martha Kropf
Chair, Building and Grounds Committee
For more than 30 years, Martha Kropf has served as an Academy docent, a member of the Architectural Selection Committee, and the Chair of the Steering and Building and Grounds Committees. In October, the Academy Fellows honored her with a Distinguished Service Award for her many contributions.

What led me to the Academy...
I had parents who woke me up to watch lightning storms and took me to natural places. It was an easy extension to take my two young children to the Academy when I moved to San Francisco 35 years ago.

Must-have for Academy visits ...
Curiosity. The Academy shows that "real" can be exciting and fun. As you walk through this place, you hear so many people saying, "Wow!"

Be sure to...
... observe the wonderful space you're in. Driving by the old Academy, you couldn't tell what happened inside. And once inside, you didn't know you were in Golden Gate Park. The genius of Renzo Piano's design for the new Academy is that you are constantly aware of the outside—a reflection of the Academy's mission to protect the environment.

On the Scene

The new Academy launches with a "bang" — pre-opening festivities set the stage for the public opening celebration on September 27.

❶ Kids meet a red-tailed boa during the Guild preview.

❷ Thomas McKinley, Trustee Janet McKinley, John Pritzker, and Lisa Pritzker enjoy a pre-opening party.

❸ Bill Oberndorf, Trustees Susan Oberndorf, Bill Patterson, and Randi Fisher, and Giles Marsden enjoying the Big Bang Gala on September 25.

❹ Dona Crowder and Eastwood Associate Sir William Fries walk through the Fries Family gallery of the Rainforests of the World exhibit.

❺ Thousands gather to see the new Academy open, and enjoy festivities in the Music Concourse.

❻ Academy Friend and Eastwood Associate Charlie Halfmann and Mary Ellen Smith chat with botanist Frank Almeda (center).

❼ Greg Farrington, Mayor Gavin Newsom and Architect Renzo Piano are on-stage after opening the museum to the public.

❽ Andrea Gooden, Susie Martinez, and Nancy McFadden of PG&E await the start of the Opening Ceremony.

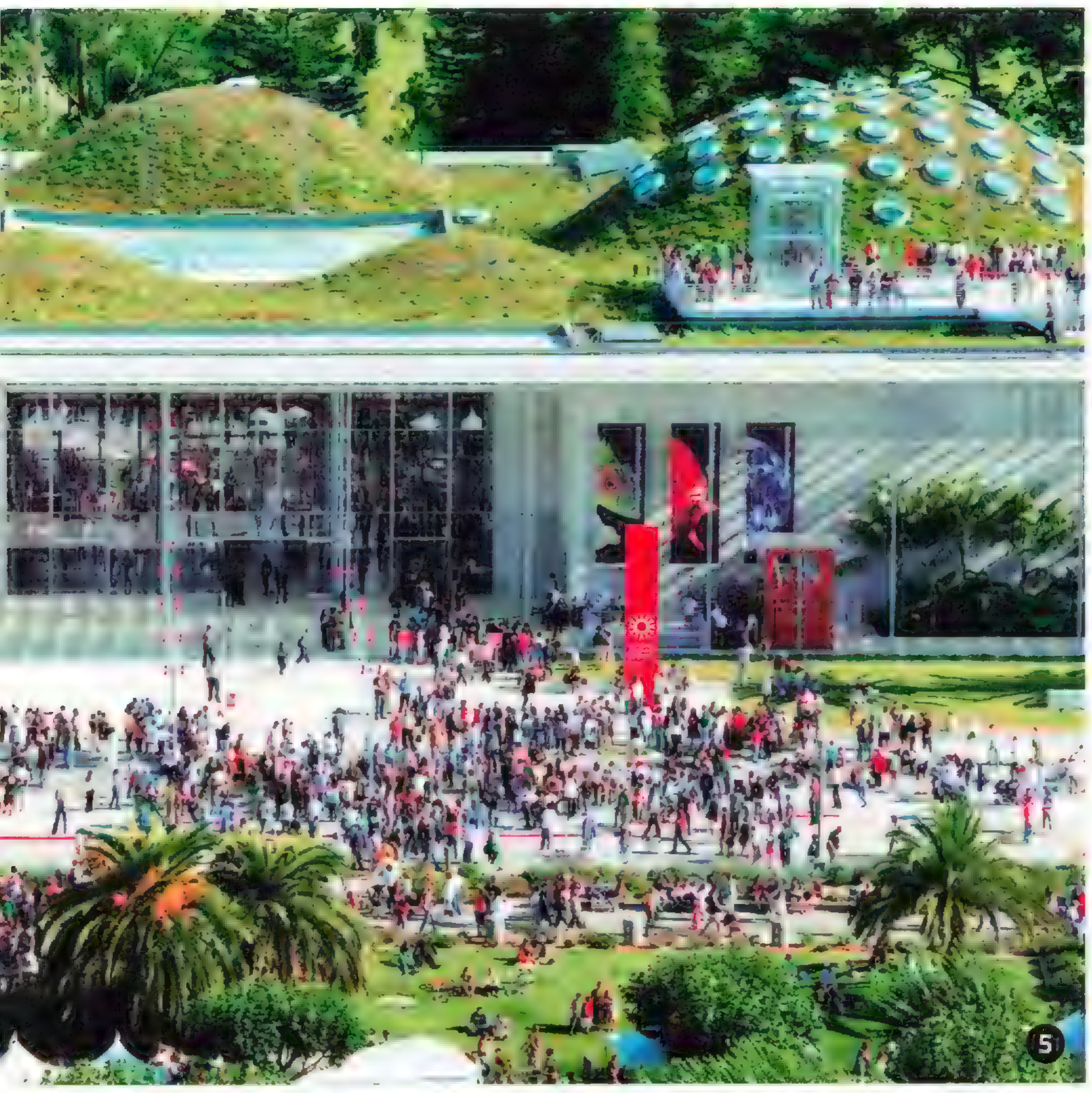
❾ Charles Villanueva, Former Mayor Willie Brown, and Wilkes Bashford visit the nearly-completed Academy.

❿ Guild members Andrew and Cassidy Trader and Marie Hurabiell enjoy a September preview.

❶

❼

❽



Get closer to science and the natural world, and be part of an exciting future by deepening your relationship with the Academy. Your increased support gives you added benefits and exclusive access to Academy happenings.

Become a Friend and enjoy exciting new benefits, including exclusive Academy events and private behind-the-scenes experiences. Learn more at www.calacademy.org/join/friends.

The greenest Guild welcomes members with children who want to learn and experience more with their families, and get involved with science in fresh and exciting ways. Learn more at www.calacademy.org/join/guild.php.

Some things do last forever. For an enduring impact, join the Eastwood Associates and make the Academy part of your estate plan. Your legacy commitment to science, discovery, education, and a more sustainable world will shape the future. Learn more at www.calacademy.org/give/planned_giving.php.

thank you!

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See You Later, Alligator

During your next visit to the Academy, don't forget to visit Claude. The Academy's albino alligator can usually be found lounging on his heated rock in the Swamp exhibit, while his tank-mate, Bonnie, trolls the surrounding waters. Albinos lack the pigment melanin in their bodies and rarely survive to adulthood in the wild.

Photo: [illegible]

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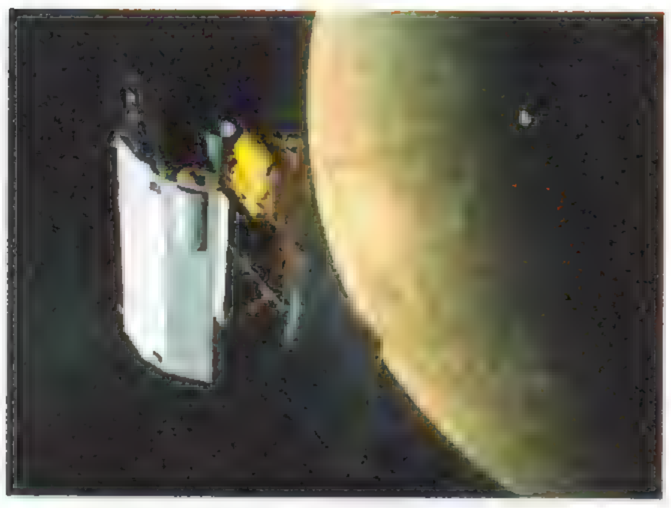
Live at the Academy

December / January / February
2008 - 2009

December

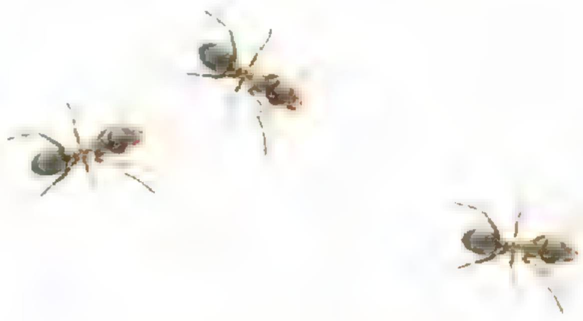


Monday, 12/15
Dean Lecture
The MESSENGER
Mission to Mercury
7:30 PM

Join Robert Gold from Johns Hopkins University as he discusses the MESSENGER spacecraft, which is on its way to orbit Mercury. For a long time, very little was known about Mercury because it is difficult to observe and study. MESSENGER has now flown by the planet twice, revealing new information about its structure and the geological processes that have shaped it. Lecture takes place in Kanbar Hall at the Jewish Community Center; tickets cost $5. For more information, see page 15.

Wednesday, 12/17
Wachovia Wednesday
9:30 AM – 5 PM

The Academy is free to the public on the third Wednesday of each month. Large crowds are expected; members may wish to attend on a different day. This program is sponsored by Wachovia.



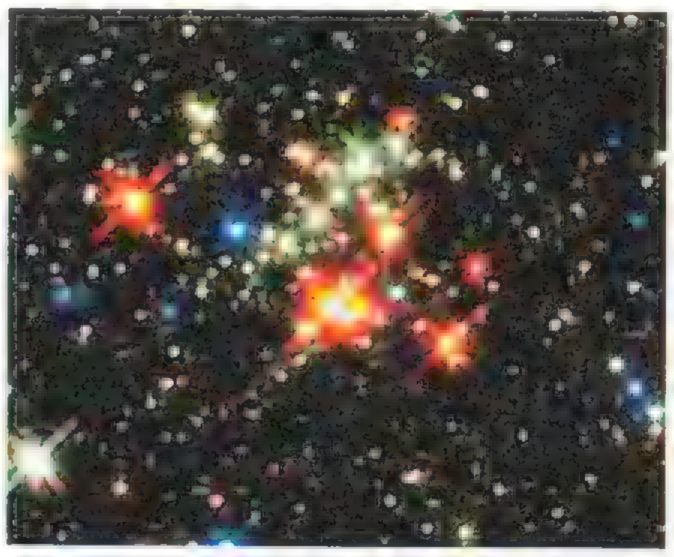
January

Sunday, 1/11
Family Appreciation Day
11 AM – 5 PM

In honor of San Francisco's fourth annual Family Appreciation Day, the Academy will be free to San Francisco families with children under the age of 18 on January 11. Large crowds are expected, and members may wish to come early to take advantage of the members-only hour from 10 – 11 AM. *Remember: members-only hours are every Tuesday from 8:30 – 9:30 AM and every Sunday from 10 – 11 AM.*

Monday, 1/12
Dean Lecture
Dark Energy and the
Runaway Universe
7:30 PM

Join Alex Filippenko from UC Berkeley as he explains why new observations suggest that the expansion of the Universe is now speeding up, rather than slowing down as expected. Lecture takes place in the Academy's Morrison Planetarium. Tickets are $5 for members, $10 non-member adults, and $8 non-member seniors. For more information, see page 15.



February

Thursday, 12/25

Academy Closed

The Academy is closed to the public on Christmas day. The museum will reopen on December 26 at 9:30 AM.

Green Tip: Lowering your hot water use means lowering both your overall water use and your energy needs. Try taking shorter showers and washing your clothes in warm or cold water only.

Wednesday, 1/21

Wachovia Wednesday

9:30 AM – 5 PM

The Academy is free to the public on the third Wednesday of each month. Large crowds are expected; members may wish to attend on a different day. This program is sponsored by Wachovia.

Monday, 1/26

Conversations at the Herbst

8 PM

Author and essayist Adam Gopnik in conversation with former Academy director Roy Eisenhardt. Lecture takes place at the Herbst Theatre, 401 Van Ness Avenue, San Francisco. Tickets are $18 for members, $20 for non-members. For more information, see page 15.

Drop-in Activities

Check out these hubs of activity, where Academy staff and volunteers are on hand every day to help you dive deeper into the natural world.

Discovery Tidepool

During your next trip to the aquarium, don't let the fish have all the fun—start splashing at the Discovery Tidepool, where visitors can handle a few of the animals that live along the California coastline, including turban snails, hermit crabs, and sea stars. The tidepool is staffed with naturalists and trained nature lovers who can answer questions about the animals and their habitat.

Open daily during museum hours.

Naturalist Center

Have a question about the natural world? The reference librarians and educators at the Naturalist Center can help you answer them. Bring in your leaves, feathers, rocks, shells, and other personal treasures for identification, look up the latest research on green technologies, or delve into "mystery boxes" full of specimens and self-guided activities.

Monday, Wednesday–

Monday, 2/2

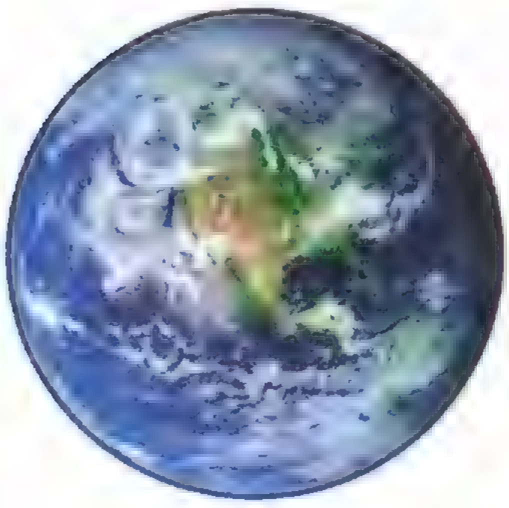
Dean Lecture
Asteroids, Evolution, and the Long-term Habitability of Earth
7:30 PM

Join David Morrison from NASA as he discusses the history of cosmic impacts and the efforts to avoid them in the future. Lecture takes place in Morrison Planetarium. Tickets are $5 for members, $10 non-member adults, and $8 non-member seniors. For more information, see page 15.

Tuesday, 2/3

The Art of Conservation
6:30 - 8 PM

Join photographers Frans Lanting and Cristina Mittermeier as they share photographs and stories from a new book and exhibition created by Conservation International and the International League of Conservation Photographers. Takes place in the Academy's Hearst Forum; free to the public. For more information, see page 14.



Tuesday, 2/10

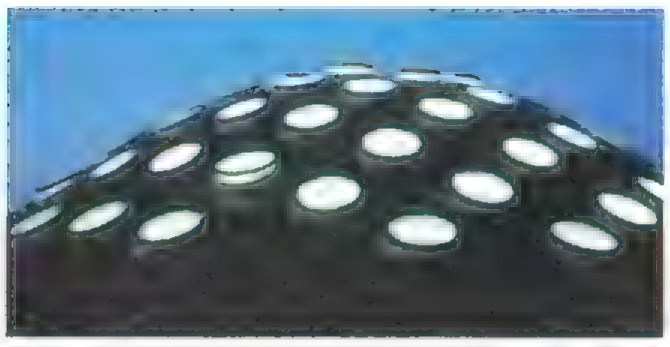
EVOLVE 2009 Lecture
Applications and Influence of Evolution
12:15 PM and 6:30 PM

The Academy's Dean of Science and Research Collections, David Mindell, will discuss the broad applications of evolutionary science, from public health to forensics to conservation, based in part on his recent book, *The Evolving World.* Free for members, $10 non-member adults, $8 non-member seniors. For more information, see page 14.

Thursday, 2/12

EVOLVE 2009 Lecture
The Young Charles Darwin
12:15 PM

How and when did Darwin actually come to his revolutionary ideas? How did a quiet and shy 27-year-old develop the most provocative idea of the past 200 years? Join Keith Thomson from the University of Oxford as he discusses these questions. Free for members, $10 non-member adults, $8 non-member seniors. For more information, see page 14.



Thursday, 2/12

NightLife
6 – 10 PM

Gaze into the stars, test your science-savvy in a science café, get up close and personal with aquarium critters, explore art with a scientific edge, and much more during the Academy's weekly NightLife events, which start on February 12. Admission is $8 for members, $10 for non-members. For more information, see page 14.

Sunday, 2/15

Donor Breakfast
8:30 - 10 AM

Annual Fund donors at the Friends level ($1,000 and above) are invited to an exclusive morning event in the museum with Academy scientists. More information to follow in January. To learn more about the Friends program, visit www.calacademy.org/join/friends/ or call 415.379.5404.

Tuesday, 2/17

EVOLVE 2009 Lecture
Patagonia and the Pampas
12:15 PM

From 1832 to 1835, Darwin traveled

extensively in the Pampas and Patagonia. Join Academy scientist Gary Williams as he presents a natural history of the region based on his own travel excursions through the region. Free for members, non-member pricing available at www.calacademy.org/events. For more information, see page 14.

Wednesday, 2/18
Wachovia Wednesday
9:30 AM – 5 PM

The Academy is free to the public on the third Wednesday of each month. Large crowds are expected; members may wish to attend on a different day. This program is sponsored by Wachovia.

Wednesday, 2/18
Conversations at the Herbst
8 PM

Author and naturalist Terry Tempest Williams will discuss some of her most recent work and musings on the natural world. Lecture takes place at the Herbst Theatre, 401 Van Ness Avenue, San Francisco. Tickets are $18 for members, $20 for non-members. For more information, see page 15.

Thursday, 2/19
NightLife
6 – 10 PM

For more information, see page 14.

Tuesday, 2/24
EVOLVE 2009 Lecture
Leaping Lizards! Charles Darwin Explores the Galápagos
12:15 PM

Join Academy scientist Terry Gosliner as he provides an accurate portrayal of how Darwin's visit to the Galápagos shaped his ideas on evolution by means of natural selection. Free for members, non-member pricing available at www.calacademy.org/events. For more information, see page 14.

Thursday, 2/26
NightLife
6 – 10 PM

For more information, see page 14.

Tuesday: 8:30 AM – 5 PM

Early Explorers Cove

Take your scientist-in-training to a special exhibit designed especially for children five and under and their caregivers. Tots can explore a 15-foot replica of the Academy's 1905 research schooner, climb into a tree-house, tend a miniature organic garden, or crawl into a child-sized burrow. The exhibit is also well-stocked with books, toys, puzzles, and dress-up costumes.

Monday, Wednesday–Sunday: 10 AM – 5 PM
Tuesday: 8:30 AM – 5 PM
Children may not be left unattended; space will be filled on a first-come, first-served basis.

Exclusive Member Benefits

Members-Only Hours

Beat the crowds, and visit the new Academy during special members-only hours, every Tuesday from 8:30 – 9:30 AM and Sunday from 10 – 11 AM.

Store Discount

Present your Academy membership card to receive a 10% discount in the Academy stores.

Every day at the Academy!

Monday

10 AM – 4 PM*	Bugs!
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
11:30 AM – 4:30 PM**	Fragile Planet
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Tuesday

10 AM – 4 PM*	Bugs!
10:30 AM – 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
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2:30 PM	Coral Reef Dive
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Friday

10 AM – 4 PM*	Bugs!
10:30 AM – 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Saturday

10 AM – 4 PM*	Bugs!
10:30 AM – 4:30 PM**	Fragile Planet
10:30 AM	Penguin Feeding
11:30 AM	Coral Reef Dive
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

Sunday

10:30 AM / Members Only	Fragile Planet
10:30 AM / Members Only	Penguin Feeding
11 AM / Members Only	Bugs!
11:30 AM	Coral Reef Dive
11:30 AM – 4:30 PM**	Fragile Planet
12 noon – 4 PM*	Bugs!
1 PM	Swamp Talk
2:30 PM	Coral Reef Dive
3:30 PM	Penguin Feeding

*Every hour on the hour
**Every hour on the half-hour

Featured Attractions

These regularly scheduled programs take place every week at the museum. Check the calendar section in this guide for information about additional special events. All programs are free unless otherwise noted.

Penguin Feeding

Location: African Hall

The Academy's African penguins are always especially animated during meal time. Watch the birds dip and dive in their new tank at the end of African Hall as a biologist dons a wet suit and hands out vitamin-stuffed herring and capelin. Each feeding takes 20 minutes, and questions are encouraged.

Daily: 10:30 AM and 3:30 PM

Coral Reef Dive

Location: Philippine Coral Reef (Lower Level)

Watch as a diver suits up in SCUBA gear and plunges into the world's deepest living coral reef exhibit. Outfitted with an underwater microphone, the diver will answer all of your reef-related questions and explain why coral reefs are among the most important—and endangered—ecosystems in the world.

Daily at 11:30 AM and 2:30 PM

Bugs!

Location: Hearst Forum 3D Theater

A remarkable foray into the fascinating world of insects, this 25-minute feature was filmed on location in the tropical forests of Borneo. Using immersive 3D technology, the film follows the life cycles of Hierodula, the praying mantis, and Papilio, the butterfly. Slide on your special viewing glasses and see for yourself what all the buzz is about.

Monday–Saturday: Every hour on the hour from 10 AM – 4 PM

Sunday: Every hour on the hour from 11 AM – 4 PM

Note: The 11 AM show on Sunday is offered exclusively for members.

Swamp Talk

Location: Swamp (L1)

Join us at the Swamp to learn about some of the Academy's most popular animals, including the albino alligator and the alligator snapping turtles. You'll find out what it takes to care for these amazing creatures, which are native to swamps in the southeastern United States.

Daily at 1 PM

Fragile Planet

Location: Morrison Planetarium

Leave Planet Earth behind as you fly to the farthest reaches of the Universe in this 30-minute show. Zoom through the roof of the Academy's building, float up through Earth's atmosphere, and gain an astronaut's view of your home—the only planet currently known to support life. Then travel to the Moon, Mars, and even beyond the Milky Way to search for habitats that might support extraterrestrial life.

Monday, Wednesday & Thursday:
Every hour on the half-hour from 11:30 AM – 4:30 PM

Tuesday, Friday–Sunday: Every hour on the half-hour from 10:30 AM – 4:30 PM

Note: The 10:30 AM show on Sunday is offered exclusively for members. Seats are limited and are available on a first-come, first-served basis.

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